ERRATA

135. In tabulations, par. 2, last column, insert + signs before 9.6 and 35.3.
152. Last paragraph, line 2, change “has” to “have,” so as to read “teachers who have had.”
161. Last paragraph, line 4, change “vocations” to “vacations.”
171. First paragraph, line 7, change “so as to make the discussion of it involve the solution” to “that will cause the discussion of it to involve the solution.”
174. Second paragraph, line 9, change “bird” “to birds.”
175. Line 7 from top, insert a comma after “history.” Line 2 from bottom, italicize “drills.”
178. Line 14 from bottom, insert the word “gaps” between “fill” and “in,” so as to read “It is useful to fill gaps in the logical development.”
181. Line 4 from top, after “college” delete “and” and replace it by a comma and a dash, and also delete “young.” Line 5 from top, delete “among.”
SCIENCE AND EDUCATION IN CHINA

A SURVEY OF THE PRESENT STATUS AND A PROGRAM FOR PROGRESSIVE IMPROVEMENT

BY
GEORGE RANSOM TWISS, B.Sc.

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE FACULTY OF PHILOSOPHY, COLUMBIA UNIVERSITY

PUBLISHED UNDER THE AUSPICES OF THE CHINESE NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF EDUCATION, PEKING, CHINA

THE COMMERCIAL PRESS, LIMITED, SHANGHAI, CHINA

1925
TO THE PEOPLE OF CHINA,

WHOSE QUALITIES I ARDENTLY ADMIRE,

AND IN WHOSE FUTURE I FIRMLY BELIEVE
# CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. The Story of the Field Work</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>2. The Outstanding Educational Problems</strong></td>
<td>11</td>
</tr>
<tr>
<td>I. Financial Support for Public Education</td>
<td>11</td>
</tr>
<tr>
<td>II. How Can the Educational System Be Extricated from Politics?</td>
<td>14</td>
</tr>
<tr>
<td>III. The Training of Teachers</td>
<td>17</td>
</tr>
<tr>
<td>IV. Help and Stimulation for Teachers While at Work</td>
<td>19</td>
</tr>
<tr>
<td>a. Summer Institutes for Science Teachers</td>
<td>19</td>
</tr>
<tr>
<td>b. A Nation-Wide Coöperative Movement for the Improvement of Science Teaching</td>
<td>21</td>
</tr>
<tr>
<td>V. The Supervision of Teaching</td>
<td>24</td>
</tr>
<tr>
<td>VI. Better Conditions for the Teachers</td>
<td>26</td>
</tr>
<tr>
<td>VII. Reforms in the Curriculums</td>
<td>28</td>
</tr>
<tr>
<td>VIII. Reforms in Teaching Practices Within the Schools</td>
<td>29</td>
</tr>
<tr>
<td>IX. Education in Thoroughness and Accuracy</td>
<td>30</td>
</tr>
<tr>
<td>X. Science Rooms, Furnishings, and Equipment</td>
<td>32</td>
</tr>
<tr>
<td>XI. Some Final Comments</td>
<td>33</td>
</tr>
<tr>
<td><strong>3. The Background</strong></td>
<td>36</td>
</tr>
<tr>
<td>I. Geographical Influences</td>
<td>36</td>
</tr>
<tr>
<td>II. The Historical Setting</td>
<td>38</td>
</tr>
<tr>
<td><strong>4. The Social Factors</strong></td>
<td>48</td>
</tr>
<tr>
<td>I. Old Conditions and New Ideas</td>
<td>48</td>
</tr>
<tr>
<td>II. Overconcentration of Population</td>
<td>49</td>
</tr>
<tr>
<td>III. Lack of Adequate Transportation Facilities</td>
<td>51</td>
</tr>
<tr>
<td>IV. Ravages of Famine and Disease</td>
<td>52</td>
</tr>
<tr>
<td>V. Ability for Coöperative and Organization</td>
<td>56</td>
</tr>
<tr>
<td>VI. The Renaissance Movement</td>
<td>57</td>
</tr>
<tr>
<td><strong>5. The Educational Situation</strong></td>
<td>61</td>
</tr>
<tr>
<td>I. The Movement Against Illiteracy</td>
<td>61</td>
</tr>
<tr>
<td>II. Education Outside the Schools</td>
<td>63</td>
</tr>
<tr>
<td>III. Molders of Public Opinion</td>
<td>67</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>CONTENTS</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>6.</td>
<td><strong>THE ECONOMIC FOUNDATIONS</strong></td>
</tr>
<tr>
<td>I.</td>
<td>Relation of Schools to the Economic System</td>
</tr>
<tr>
<td>II.</td>
<td>Education and Economic Reconstruction</td>
</tr>
<tr>
<td>III.</td>
<td>The Fine Arts and Art Handicrafts Must Be Preserved and Promoted</td>
</tr>
<tr>
<td></td>
<td><strong>POLITICAL FACTORS AFFECTING EDUCATION</strong></td>
</tr>
<tr>
<td>I.</td>
<td>The Schools Are Involved in the Political System</td>
</tr>
<tr>
<td>II.</td>
<td>Results of Political Control</td>
</tr>
<tr>
<td>8.</td>
<td><strong>CAN THE SCHOOLS BE EXTRICATED FROM POVERTY AND POLITICS?</strong></td>
</tr>
<tr>
<td>I.</td>
<td>The Conditions Summarized</td>
</tr>
<tr>
<td>II.</td>
<td>The Way Out. An Ideal Educational System</td>
</tr>
<tr>
<td>9.</td>
<td><strong>THE CHINESE SYSTEM OF EDUCATION</strong></td>
</tr>
<tr>
<td>I.</td>
<td>The Old System</td>
</tr>
<tr>
<td>II.</td>
<td>Beginnings of the Modernized System</td>
</tr>
<tr>
<td>III.</td>
<td>Educational Progress Under the Republic</td>
</tr>
<tr>
<td>10.</td>
<td><strong>THE ELEMENTARY SCHOOLS AND NATURE STUDY</strong></td>
</tr>
<tr>
<td>I.</td>
<td>Relations to the System as a Whole</td>
</tr>
<tr>
<td>II.</td>
<td>The Elementary Curriculum</td>
</tr>
<tr>
<td>III.</td>
<td>Nature Study, Agriculture, and Geography</td>
</tr>
<tr>
<td>IV.</td>
<td>Need of a Program for Helping the Teachers</td>
</tr>
<tr>
<td>V.</td>
<td>Economic Status of the Elementary Teachers</td>
</tr>
<tr>
<td>VI.</td>
<td>Some Forward Steps</td>
</tr>
<tr>
<td>11.</td>
<td><strong>THE MIDDLE SCHOOLS</strong></td>
</tr>
<tr>
<td>I.</td>
<td>Beginnings and Growth</td>
</tr>
<tr>
<td>II.</td>
<td>The Enrollments Are Small</td>
</tr>
<tr>
<td>III.</td>
<td>Tendencies in Curriculum Administration</td>
</tr>
<tr>
<td>IV.</td>
<td>The Students</td>
</tr>
<tr>
<td>12.</td>
<td><strong>THE TEACHERS OF THE MIDDLE SCHOOLS—THEIR QUALIFICATIONS AND SALARIES</strong></td>
</tr>
<tr>
<td>I.</td>
<td>Personal Qualities</td>
</tr>
<tr>
<td>II.</td>
<td>Education and Training</td>
</tr>
<tr>
<td>III.</td>
<td>Experience</td>
</tr>
</tbody>
</table>
# CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV. Salaries</td>
<td>159</td>
</tr>
<tr>
<td>13. METHODS OF TEACHING. MEMORY DRILLS AND LECTURES</td>
<td>165</td>
</tr>
<tr>
<td>I. The Memoriter Recitation Method</td>
<td>165</td>
</tr>
<tr>
<td>II. The Drill Method</td>
<td>171</td>
</tr>
<tr>
<td>III. The Lecture Method</td>
<td>176</td>
</tr>
<tr>
<td>14. METHODS. CLASS CONFERENCE AND LABORATORY</td>
<td>182</td>
</tr>
<tr>
<td>I. Developing Initiative and Thinking Ability</td>
<td>182</td>
</tr>
<tr>
<td>II. How to Make Students Think</td>
<td>183</td>
</tr>
<tr>
<td>III. How We React to a Problematic Situation—An Illustration</td>
<td>184</td>
</tr>
<tr>
<td>IV. Analysis of a Complete Act of Thought</td>
<td>186</td>
</tr>
<tr>
<td>V. How to Conduct a Class-Conference Lesson</td>
<td>187</td>
</tr>
<tr>
<td>VI. Problem Solving and the Organization of Knowledge</td>
<td>191</td>
</tr>
<tr>
<td>VII. The Laboratory Method</td>
<td>192</td>
</tr>
<tr>
<td>VIII. The Choice of Laboratory Experiments—Criteria</td>
<td>193</td>
</tr>
<tr>
<td>IX. How to Introduce and Carry on the Laboratory Method</td>
<td>195</td>
</tr>
<tr>
<td>X. Projects and Their Function in Teaching</td>
<td>199</td>
</tr>
<tr>
<td>XI. The &quot;Dalton Plan&quot;</td>
<td>201</td>
</tr>
<tr>
<td>XII. Relation of Projects to More Formal Methods</td>
<td>201</td>
</tr>
<tr>
<td>15. THE TEACHERS IN ACTION. THEIR METHODS SUMMARIZED</td>
<td>203</td>
</tr>
<tr>
<td>I. How the Observing Was Done</td>
<td>203</td>
</tr>
<tr>
<td>II. The Methods Used by the Teachers</td>
<td>204</td>
</tr>
<tr>
<td>III. Reports on Methods from the Questionnaire</td>
<td>209</td>
</tr>
<tr>
<td>IV. How the Teachers Can Help Themselves</td>
<td>212</td>
</tr>
<tr>
<td>16. SELECTIONS FROM THE FIELD NOTES—WITH CONSTRUCTIVE CRITICISMS</td>
<td>216</td>
</tr>
<tr>
<td>I. &quot;Moving Pictures&quot; from the Schoolrooms</td>
<td>216</td>
</tr>
<tr>
<td>II. Notes from City Number 1</td>
<td>217</td>
</tr>
<tr>
<td>III. Good and Faulty Procedure from City Number 2</td>
<td>225</td>
</tr>
<tr>
<td>IV. Examples from City Number 3</td>
<td>232</td>
</tr>
<tr>
<td>V. Observations in City Number 4</td>
<td>239</td>
</tr>
<tr>
<td>VI. Illustrations from City Number 5</td>
<td>252</td>
</tr>
</tbody>
</table>
17. **VITALIZED CURRICULUMS** ........................................ 258
   I. Educational Objectives ........................................... 258
   II. New Curriculums Recommended ................................ 261
   III. The General Curriculum ....................................... 262
   IV. The Household Arts Curriculum ................................ 274
   V. The Industrial Curriculum ...................................... 276
   VI. The Commercial Curriculum .................................... 278
   VII. The Agricultural Curriculum .................................. 280
   VIII. The Normal School Curriculum ............................... 280

18. **SCIENCE ROOMS AND BUILDINGS** ............................... 283
   I. Observed Conditions ............................................ 283
   II. A Unit System of Standard Science Rooms .................... 285
   III. Standards for Lighting of Rooms .............................. 287
   IV. How to Plan a Building or Rooms for Science Work ......... 290

19. **CLASSROOM AND LABORATORY FURNISHINGS** ................. 293
   I. Conditions Observed in the Schools ............................. 293
   II. Demonstration Tables .......................................... 296
   III. Laboratory Tables for Chemistry .................................. 297
   IV. Laboratory Tables for Physics .................................. 301
   V. Tables for Biology ................................................ 303
   VI. Tables for Other Science Work ................................ 304
   VII. Fume Hoods for Chemistry .................................... 304
   VIII. Other Furniture ............................................... 306
   IX. Science Classrooms ............................................. 307
   X. Apparatus and Stock Rooms ..................................... 309

20. **APPARATUS AND EQUIPMENT** .................................... 311
   I. What the Schools Have ........................................... 311
   II. Condition .......................................................... 312
   III. Much of the Apparatus Defective in Construction .......... 313
   IV. China Should Have Reliable Apparatus Houses ............... 314
   V. Museum Specimens ................................................ 316
   VI. Laboratory Apparatus Is Wanting and Should Be Supplied ... 318
   VII. How to Select Laboratory Equipment .......................... 320
   VIII. Help and Self-Help on Apparatus Problems ................ 320
   IX. Homemade Apparatus .............................................. 321
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>THE NORMAL SCHOOLS</td>
<td>323</td>
</tr>
<tr>
<td></td>
<td>I. Character and Distribution</td>
<td>323</td>
</tr>
<tr>
<td></td>
<td>II. Cost of Normal School Education</td>
<td>325</td>
</tr>
<tr>
<td></td>
<td>III. The Normal School Students and Teachers</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>IV. Curriculums</td>
<td>331</td>
</tr>
<tr>
<td></td>
<td>V. Rooms and Equipment</td>
<td>337</td>
</tr>
<tr>
<td>22.</td>
<td>THE TRAINING OF TEACHERS FOR SCIENCE</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>I. The Controlling Factor in Scientific Develop-ment</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>II. A Broader Conception of Teaching Aims</td>
<td>344</td>
</tr>
<tr>
<td></td>
<td>III. Special Need for Teacher-Training Cur-riculums</td>
<td>349</td>
</tr>
<tr>
<td></td>
<td>IV. A Contribution to Curriculum Reorganiza-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V. Courses for Teachers in Service</td>
<td>351</td>
</tr>
<tr>
<td></td>
<td>VI. Training Science Teachers for Community</td>
<td>357</td>
</tr>
<tr>
<td></td>
<td>Leadership</td>
<td>359</td>
</tr>
<tr>
<td></td>
<td>VII. Conclusion</td>
<td>360</td>
</tr>
</tbody>
</table>
CHAPTER 1

THE STORY OF THE FIELD WORK

DURING the latter half of the year 1921, Professor Paul Monroe, of Teachers College, Columbia University, working under the auspices of the Chinese National Association for the Advancement of Education, made an extensive tour in China for the purpose of lecturing on educational administration, and making a critical investigation of the schools and higher institutions. Professor Monroe discovered many serious defects in the system of education, and pointed out with particular emphasis the weakness and inadequacy of the science instruction, and the urgent need for improving it. He placed especial emphasis on the importance of widespread knowledge of science, and skill in the use of the scientific method of problem solving, as factors in the improvement of economic and social conditions in China, and urged the cultivation of the scientific spirit as an agency in securing a better civic consciousness and cleaner and more efficient administration of politics.

More specifically, Professor Monroe recommended to the association that it secure the services of a specialist in science teaching who should spend two years in studying the situation from the standpoints of social and industrial needs and of conditions in the schools, and in lecturing on the significance of science in national progress and on modern methods of science instruction. The aim of this recommendation was to set up a program for constructive work by government and other administrative agencies for modernizing the system of science teaching, especially in the most significant and influential cities and institutions.

As one result of Professor Monroe’s activities and recommendations, I was invited to fulfill a two-year
engagement with the Chinese National Association for the Advancement of Education as its Director of Science Education. The specific work assigned to me was to investigate existing conditions and set up a constructive program. The invitation was accepted; and, accompanied by my wife, I arrived at Shanghai, June 30, 1922. Immediately on landing, we were welcomed by a committee representing the Chinese National Association for the Advancement of Education, the Science Society of China, the National Southeastern University, and the Commercial Press. Through the kind ministrations of these gentlemen, we were relieved of all the troubles that usually assail the traveler in a country whose language and customs he does not know.

They provided most hospitably and delightfully for our entertainment, for sight-seeing trips in Shanghai and Nanking, and for personally conducting us on the journey between the two cities. My first lecture in China was delivered on July 1, at the headquarters of the Science Society of China, in Nanking. The audience was composed of the local members of the society, and the advanced students of the National Southeastern University. The subject was "Science Teaching and Research as Factors of National Progress." A dinner given by the society, after the lecture, gave me the opportunity to become acquainted with the Chinese scientists in Nanking, nearly all of whom speak English fluently.

This occasion afforded me great assistance in the work immediately before me, because it enabled me quickly to become acquainted in their broad outlines with the most important scientific and educational problems of China. It gave me an airplane sketch of conditions relating to my subsequent work, which I could fill in more rapidly as opportunity arose, since I was enabled better to know what to look for.

On the next day, July 2, we set out for Tsinan to attend the first annual meeting of the Chinese National Association for the Advancement of Education. We were
conducted by Professor King Chu, formerly of the Peking National University, and now of the editorial staff of the Commercial Press.

Here again opportunity arose for contact with many of the educational leaders, both Chinese and foreign. My second address in China was delivered before this convention, and was ably interpreted by Professor King Chu. The subject was "Rational Methods in Education." During the sessions, a round-table meeting was held with the leading science teachers present, in which a tentative program for my work was drawn up. This was subsequently amended and perfected, and was approved by the trustees of the association at their meeting in Peking in the following September.

After the adjournment of the Tsinan convention, I returned to Nanking to give a course of lectures on science teaching at the summer session of the Southeastern University. Several of these lectures were repeated at Nanking University, and a little later at Nankai College in Tientsin.

Simple ideas and simple apparatus for science teaching, motivation, science and the curriculum, the sequence of science studies, correlation, and the project method were the topics treated of in these lectures, in connection with which it was my good fortune to have the coöperation of Professors C. Wong and C. C. Chen in Nanking, and of Dr. Ling Ping, dean, and Dr. Chiu, professor of chemistry, of Nankai College, at Tientsin. It was the ability of these educators as interpreters which made possible whatever of success these lectures may have had.

The remainder of the hot season was spent at the beautiful seaside resort of Peitaiho, where, during a short period of vacation, it was possible to make useful contacts with some of the prominent foreigners in educational work and to gain much information from them. During this period, a trip was made to Nantungehow to attend the annual meeting of the Science Society of China.
At this meeting I gave an address on "Science Teaching in American Schools." The society appointed a committee to cooperate with me in carrying out my plans for work in China, which were before them in mimeographed translations.

In September, the work began in Peking with a number of conferences, and an address before the National Conference of Provincial Delegates for the Reorganization of Education, called by the Ministry of Education. The subject was "Economic Development as Related to Education and Scientific Progress in China."

Immediately following this meeting, and conferences with local science teachers, and trustees of the association, the field work was begun by visiting science classes and inspecting equipments in Peking. The field work in Peking was followed during the fall and winter by trips to Mukden, Tientsin, Paoting and Changteh, Kaifeng, and Tsinan. Each trip consumed from five to nine days, and involved individual round-table conferences with science teachers, administrators, and officials, and lectures and addresses to mass meetings of teachers, of students, and of both.

It was thought desirable at first that I should not dissipate my energies by much public speaking, but should confine the speaking in each city to one lecture to all the teachers and one address to all the students. In this way, I had hoped to conserve my strength for the investigation and conference work. However, it turned out to be seldom feasible to secure a hall large enough to accommodate all the students who wanted to attend; and the interest of the students was so great, and their requests for a message from the American guest were so urgent and insistent that it was impossible to refuse. So in nearly every city visited from five to ten addresses were given to students in various centers.

These contacts with large student audiences, who maintained an attitude of serious attention and earnest
responsiveness almost without exception, proved to be most inspiring.

As a result of thus meeting thousands of Chinese youth and hundreds of their teachers face to face, there has grown up within me an abiding faith in the future of China, and a deep conviction that in spite of their superficial turbulence and occasional undisciplined and lawless acts, the students of China are morally sound. However ill considered their methods occasionally are, they stand for patriotic ideals and good citizenship; and the country will be quieter, more prosperous, and safer when in due time control of affairs shall pass into their hands.

Unfortunately, the field work of the first winter was interrupted by a serious illness, which confined me in hospital and at home and prevented me from working, for a period of about a month.

During the spring of 1923 the cities of Wusih, Soochow, Shanghai, Hangchow, and Nantungchow were visited, the survey and speaking activities being similar to those previously described; and at the request of the Anhwei authorities a special intensive survey of the educational institutions of Wuhu and Anking was made, the results of which are embodied in a report of one hundred typed pages which has already been translated into Chinese. It is on file with the authorities, and also has been published in the *New Education*.

During the summer, at the National Southeastern University, I gave a course on the "Principles of Science Teaching," in the regular college session. This course was attended by seventy-eight teachers and advanced students. Of these, fifty-eight were enrolled for credit, and fifty-four passed the examination and received credit. Also, at the request of the Kiangsu Educational Association and the Kiangsu Commissioner of Education, I conducted a two weeks' institute for the Kiangsu science teachers in coöperation with Professors Hu, Chang, and Chen, of the departments of Physics, Chemistry, and Biology of the
Southeastern University. In both the college course and the institute, Professor C. Wong was my very able and faithful interpreter.

This institute was attended by fifty-eight teachers; and while the time was all too short to accomplish a great deal, yet the interest and activity of those attending were such as to make us feel that the institute was well worth while. The enterprise and liberality of the Departments of Education of Kiangsu and Fengtien in sending large numbers of their teachers to attend these college and institute courses, and paying their expenses, is highly to be commended. It points the way for working out a policy that will help immensely in solving the problem of better science training for science teachers.

The end of the summer session brought a welcome respite from the summer heat and humidity of the Yangtze valley in the form of a few days’ stay in the famous and unique mountain resort, Kuling, where two very inspiring and profitable meetings were held with the science teachers of the Christian schools. Then came a flying trip to Peking, attendance on the meeting at Tsing Hua College of the annual convention of the Chinese National Association for the Advancement of Education, and the delivery before the convention of a report on the progress and findings of the science survey to date.

After a few days more of enforced but most welcome vacation at Kuling, caused by military and bandit operations at points to be visited, and by consequent delays in the opening of the schools, the survey itinerary was resumed and the schools of Kiukiang, Nanchang, Chungking, Ichang, Wuchang, Hankow, and Nanking were successively visited. As we proceeded, there was a progressively insistent demand for more lectures and addresses, and an overflow of hospitality and generosity on the part of the teachers’ associations and officials that knew no bounds. The interest and cooperation of the teachers in every city was most gratifying. It leaves a bright memory of the generosity, kindness, hospitality,
and open-mindedness of the Chinese which never can be dimmed.

In the spring and fall of 1923, two special trips were made to Shanghai to meet with the Technical Board on Physics of the East China Christian Educational Association, which is engaged in the project of working out a laboratory manual and standard equipment for teaching physics. This board is working on especially practical lines, and I am confident that much good will be accomplished by it.

December first found us again in Peking where my time has been spent in writing addresses, magazine articles, reports, and bulletins embodying organization plans for carrying out a constructive country-wide program, in coöperating in the planning and setting up of an institute for college science teachers to be held July 10 to August 8, 1924, at Tsing Hua College under the joint auspices of the Chinese National Association for the Advancement of Education, Tsing Hua College, and the China Medical Board, and in lecturing at the two national teachers’ colleges, and elsewhere in the Peking district. The very evident success of the lectures and addresses in Peking was due very largely to the fine and vigorous interpretation by Dr. Y. G. Chen, of the Peking National Normal University, and Dr. Y. C. Chang, of the Girls’ National Normal College.

On February 5–7, I attended a conference at Nanking of the Christian colleges and universities, which was one of the best-organized educational conventions that I have attended anywhere. At this conference I delivered a paper on “Some Fundamental Factors in the Educational Situation” and also presented a plan for cooperative effort of Chinese and foreign science teachers through a national movement for the improvement of science teaching, with the backing of the Chinese National Association for the Advancement of Education, the China Christian Education Associations, and the Science Society of China. The conference voted to give active support to this project.
Statistically, the main features of my activities may be summed up as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>TO AUG, 20, 1923</th>
<th>TO FEB, 15, 1924</th>
<th>TO JUNE 15, 1924</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provinces visited</td>
<td>7</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Cities visited</td>
<td>15</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Schools and colleges inspected</td>
<td>125</td>
<td>187</td>
<td>190</td>
</tr>
<tr>
<td>Total typed pages of serial reports completed</td>
<td>226</td>
<td>237</td>
<td>248</td>
</tr>
<tr>
<td>Special summarized reports, pages</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Magazine articles and bulletins, pages</td>
<td>0</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td>Total typed pages completed, exclusive of final report</td>
<td>256</td>
<td>328</td>
<td>339</td>
</tr>
<tr>
<td>Number of round-table science conferences held</td>
<td>15</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>Number of addresses and lectures to teachers</td>
<td>15</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>Number of addresses and lectures to teachers and students</td>
<td>20</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Number of addresses and lectures to students</td>
<td>15</td>
<td>37</td>
<td>50</td>
</tr>
<tr>
<td>Number of addresses to national conventions</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Number of addresses to miscellaneous and special audiences</td>
<td>3</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Number of lectures in summer sessions and institutes at universities</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Number of after-dinner speeches on science and education</td>
<td>4</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Total lectures, addresses, and round-table conferences</td>
<td>110</td>
<td>156</td>
<td>176</td>
</tr>
<tr>
<td>Total number of miles traveled by railroad and steamboat in China</td>
<td>3,908.5</td>
<td>15,112.2</td>
<td>15,112.2</td>
</tr>
</tbody>
</table>

Besides these activities, many individual conferences and conferences with small groups of school officials and teachers have occurred, both incidentally and in direct connection with the field work. Also visits to small industries, factories, reclamation projects, etc., have been made in considerable number. These contacts with people and industries have been very helpful in getting a background of information concerning the conditions which affect education and its function in the Chinese social order.

The story of my activities would be indeed incomplete without some attempt towards acknowledgment of my
obligations to those who have encouraged and assisted me. First, my grateful thanks are extended to Director W. T. Tao and the officers and trustees of the Chinese Association for the Advancement of Education, to the China Medical Board, and to Professor Paul Monroe and the Institute for International Education, through whose cooperation it was made possible for me to undertake and carry out this international service. My thanks are due also to the authorities of the Ohio State University for granting me a two years' leave of absence.

Professor Tuh Liu, of the National Peking Teachers College, Mr. H. T. Hsueh and Mr. Monroe Tang, of the Chinese National Association for the Advancement of Education staff, and Professor Tsun Chang, of the National Southeastern University, acted in turn as managers and interpreters on my extended field trips. I am very grateful to them for their able services in managing my trips and appointments, and in enabling me to understand and be understood, for helping me in my sincere but unskilled efforts to observe the social amenities according to the customs of the country, and for the care and solicitude with which each one of them looked after every detail for my comfort and safety, and that of my wife when she accompanied me.

My wife, Blanche Olin Twiss, has helped me with the typewriter, with suggestions and criticism, and in many other ways too numerous to be mentioned.

Mr. Daniel C. Yü, a student of Shantung Christian University, rendered very valuable service as interpreter in Tsinan.

In every city, generous assistance was given by local educators, in the form of guidance and interpretation, in the work of observation and conferences, and often also in delivering addresses. It would be impossible adequately to acknowledge all the courtesies received by our parties as guests in the various cities. We were lavishly entertained everywhere at dinners and luncheons by the military and civil governors of the provinces,
either in person or through their official representatives, by the commissioners of education, the officers of the provincial and local educational associations, the local members of the Chinese National Association for the Advancement of Education, and the heads of government schools and colleges, mission schools and colleges, and the Young Men’s Christian Association. The hospitality and generosity, and the hearty cooperation of all those whom we were endeavoring to assist by our work was almost overwhelming; so that we do not know how we may properly express our thanks and appreciation.

Nearly everywhere we were privileged to enjoy the hospitality of the homes of local foreigners—missionaries or Young Men’s Christian Association secretaries. These visits among the representatives of our own and other Western countries, who are unselfishly devoting their lives to helpful services in China,—humanitarian and educational of every sort, as well as religious,—meant much more to us than mere escape from hotel life. We were encouraged and inspired by the devotion and enthusiasm, the faith in the future of the Chinese people, and the quiet effectiveness of these foreign friends. Wherever we went, friendships were formed with Chinese and foreigners which enlarged our minds and hearts and which will be gratefully cherished throughout our lives.
CHAPTER 2

THE OUTSTANDING EDUCATIONAL PROBLEMS

I. FINANCIAL SUPPORT FOR PUBLIC EDUCATION

The largest and most difficult problem of education in China is the problem of adequately financing the educational system. The development of the system since 1903, when it began to be conceived from a modernized viewpoint, has been most remarkably creditable, even though it has fallen very far short of being satisfactory. Certainly the progress that has been made during the past thirty years has been greater than that made by public education in America during the first thirty years of its existence.

The conception of public education in China is so broad in its scope and so far-reaching in its details that it is easily the biggest public social project with which the country is attempting to deal. It touches every phase of the national life. The proper solution of all other big national problems depends on an adequate and effective development of public education.

This is true because trained minds and disciplined consciences and wills are necessary to solve all the social, economic, and governmental problems which the nation is facing in its new development; and the knowledge and training that must be possessed by those multitudes who are to solve the problems

creditable progress has been made.

The educational system is broadly conceived.

It must train the experts and workers for the development of the new China.

---

1 The evolution of this conception is touched upon in Chaps. 3 and 5, and it is outlined in Chap. 9.
and do the work must, for the most part, be gained by them in the public schools and colleges.

In Chapter 6, the problem of financing education is considered in connection with the problem of the economic development of China. It is there held that the abundant natural resources and intelligent and industrious man power of the nation, hold within themselves potentialities of great wealth and prosperity; and that the unique opportunity is presented to build in China a new social and economic order through a reconstruction of the economic system. If it is to be an economic reconstruction instead of an industrial revolu-
tion involving the disastrous wastes of class warfare, then labor and the public must be allowed their fair shares of the increased production made possible by science, machinery, and the efficient organization of labor. A new type of industrial leaders and managers must be reared and educated; and the schools must address themselves to the task. Thus the educational system is not only dependent on the new order for its maintenance and expansion. It must be the most potent agency in bringing the reconstruction to pass.

The educational system needs intensive improvements from within; and the units need to be expanded and multiplied so as to place education within the reach of all the people. It is possible to effect certain economies within the system, and to increase the efficiency of various units in a number of different ways. One of these is consolidating existing small schools. Another is to increase the enrollments of existing units. Another is to improve the curriculums and administration. These are discussed in Chapters 9 and 10. Some good progress has already been made in these directions.
and record progress. All available means should be utilized for increasing the efficiency of administration and teaching, and for effecting economies that will save funds to be expended on better equipment; but it should be clearly understood that large expansions of the school system must await and go along with the economic development. If expansion should too far outstrip the available revenues, there is danger of multiplying ineffective schools, whose failures will tend to discredit modern education among the people. Therefore, the policy recommended and urged is to expand the system slowly, and to place the greatest possible effort on making the existing schools as efficient as it is possible to make them.

Ultimately, the schools must be supported mainly by local voluntary taxation. Their control, and the power to fix the tax rate for school purposes, must be placed in the hands of local representative school boards, whose acts are not subject to the dictation of other political officials. Then each community will tax itself for schools through its representative school board, and should get as good schools as it is able or willing to pay for. There should, of course, be provision for provincial subsidies to be granted to those poorer districts that cannot finance their schools without some help. In the meantime, care should be taken to make the existing schools so good that the people will desire more of them and be willing to pay for them, and that they will be able to see for themselves what really good schools are.

A paper program for education, no matter how good it may be, is of little value unless it is thoroughly carried out in its details as planned—unless the things that are designated to be done on the proper program are actually put into daily practice in the schools. So you cannot establish real schools faster than you can train teachers to conduct them, or faster than you can provide salaries to pay those teachers regularly.
II. How Can the Educational System Be Extricated from Politics?

The financial problem is tied up with the problem of evolving a reunited country and a stable, honest, and efficient government in the provinces and the national capital. This is also a fundamental and an outstanding problem. Its solution conditions the economic development which will make possible adequate schools and all other internal improvements that contribute to the health, efficiency, comfort, and spiritual development of all the people.

Not only are the present means of financing the schools under the control of politics, but so also are the internal governments and managements of the schools themselves. The schools and colleges never can be as efficient as they ought to be until their support and their internal management are divorced from politics. Here, again, the educators have it largely within their power to work out the salvation of the educational system, by rearing a new generation of citizens with better civic ideals and better civic consciences than are found among the generation now in control. How the schools are tied up with the political system, and what it may be possible to do in order to remedy this unfortunate situation are questions that are discussed in Chapters 7 and 8. Some hopeful lights are thrown on the problem from the historical and social standpoints in Chapters 3 and 4, wherein the environment, the historical development, the social aspects, and the temper of the people are briefly sketched and interpreted, especially with relation to science and education.

The evolution of politics towards a better state must come very largely through a better and more effective system
of teaching citizenship. Instruction must be by both practice and precept, especially in connection with student activities, with community projects, and with such school studies as science, history and civics, economic geography, elementary economics and sociology, and with readings and debates on the problems of democracy. Especially must science education and moral and civic education go along together, else knowledge and proficiency in science and technology may lead internally to the selfish application of science in the exploitation of labor and the public for the enrichment of the privileged few. Likewise, without altruistic motives deeply implanted, knowledge and control of science and machinery may lead China externally into the baleful path of economic imperialism.

This is what has happened with the Western nations, who, if they continue on this path, will employ science and machinery to destroy one another. This they have already well-nigh done by the Great War, and by the international strifes that have followed in its wake. Economic imperialism leads to wars; and wars, if continued, will wipe out civilization.

There is another important factor of this problem that must not be overlooked by the educators themselves. If the schools are to be kept out of politics, and delivered from the impoverishing effects of political “squeeze,” then politics and “squeeze” must be kept out of the schools.

The schoolmen everywhere must cease factional strife within their own schools. They must refrain from splitting up into factions and cliques among the various schools. They must present a united front and work together in harmony for the interests of all the schools, and not for the advantage of any group or clique.

They must also adopt and practice reforms in their accounting systems.
All sums received from every source, and all sums disbursed for any purpose, should be entered in classified accounts. Receipts should be given for all moneys and goods received; and vouchers should be demanded, received, and kept on file for all payments made. Every voucher should be made out on a numbered blank from a bound book in which a stub or a carbon copy corresponding to each and every voucher is preserved for permanent record. Having installed and kept a scientific system of bookkeeping, the school executives should demand an annual or semiannual audit of their accounts by expert and honest auditors, whose reports should be available to the public. These auditors should verify all balances and vouchers and ascertain that there is a voucher stub for every receipt, and a voucher signed by a properly authorized person for every payment. In many places visited there were numerous and open charges of "squeezing" and playing politics; and in not a few cases such evils were said to be the direct causes of student strikes, the frequent occurrence of which at present is playing havoc with the discipline and efficiency of the schools.

I think that only a relatively small proportion of the school people play politics or indulge in the time-honored game of "squeeze"; but if the statements that have been made to me by reliable persons are not mistaken, enough of them have done so to establish the need for the policy that has been outlined above. It is a universal custom in America, and is required by law for the protection of the school funds. The subject of local administration and internal fiscal management of the schools has been discussed at considerable length in Chapter II of my report on the schools Wuhu and Anking, province of Anhwei, and published in Chinese in the *New Education*.

---

III. THE TRAINING OF TEACHERS

By visitation in hundreds of classrooms in nearly all kinds of schools, the judgment has been reached that the teachers in general compare favorably in intellect and personality with teachers of similar ranks anywhere; but that relatively few of the science teachers are highly skilled in the art and technic of teaching. This is true of subjects other than science, particularly of English, mathematics, history, geography, etc. In a very great majority of the cases the teaching is almost exclusively by lecturing. The teacher does all the talking, and the pupils seldom or never react. This is largely true, even in the primary schools. As to science, systematic laboratory practice by the students under the supervision of the teacher is rare, even in many of the higher institutions (excepting in chemistry) and is found only exceptionally in the middle and (secondary) normal schools.

In general, the secondary teachers are not skillful in experimenting or in directing experimenting by students; and they do not know how to handle a class by recitation methods. Fair or good lecturing is not so rare; and perhaps from five to ten percent of the science teachers are very effective lecturers. A few are excellent. It seems quite clear that, in general, the teachers in the middle and normal schools are failing to give their students real training and real insight into science and the scientific method of problem solving. Thus these schools are failing to perform one of their most important and far-reaching tasks. This failure of the teachers is due not to lack of ability, but to the defective character of their own training. They have not themselves been carefully trained in the laboratory to experiment and reason with thoroughness and exactitude. Most of them have taken many
courses in science; but not many have had any real scientific training.

The remedy, therefore, is obvious. The opportunity must be given them to make good their deficiencies in courses offered in the colleges and universities and designed especially to give them the training that they lack, in scientific thinking, in careful experimenting, and in methods of teaching.

Such courses should be provided in the regular sessions and especially in summer sessions; and each term a certain number of teachers should be selected from each province and sent to take them. Leaves of absence and some expense allowance should be granted for the purpose. If this plan were followed up each term by the provinces, all the science teachers now in service could be sent for one term’s training within five or six years; and a great change for the better would result, provided, of course, the professors who conduct these courses use the right methods. Besides a concerted and country-wide plan for the training of teachers in service there should be a thorough awakening of the higher institutions, government, private, and missionary, to the task of giving more thorough and effective training to prospective teachers, and towards attracting more of the ablest students into the teaching profession.

The character and development of the middle schools, and the training, experience, and salaries of the teachers are reported in Chapters 10 and 11. It is there shown that the teachers as a rule have had a creditable amount of middle school and collegiate courses. But the trouble is that it has been too bookish and too vicarious in character,—too much talk by the professors and not enough work by the learners,—too much instruction and not enough training, too much pouring in and not enough drawing out.

In Chapter 21, the same is shown to be true of the teachers in the normal schools for the training of
Chapters 13-16 discuss teaching practices as they should be, elementary teachers. Chapters 13 and 14 are written for the benefit of teachers, administrators, and supervisors; and they discuss analytically the standard modern methods of science teaching. Chapters 15 and 16 discuss critically the teaching practices actually observed in the schools, as judged from the viewpoint of one familiar with the standard modern methods.

and as they are. For the teachers themselves, these four chapters should be the most useful part of this volume. They ought to be read and discussed in science teachers' clubs and round tables in every city. They ought also to be highly useful as textbook and discussion material in collegiate courses not only for the training of science teachers especially, both prospective and now in service, but for teachers of other subjects as well.

College authorities and school administrators must cooperate to solve this problem. This problem of reform and extension of the program of teacher training is the most fundamentally important and immanent of those whose solution is directly in the hands of the administrators of the schools and colleges. It is discussed at greater length in Chapter 22.

IV. Help and Stimulation for Teachers While at Work

a. Summer Institutes for Science Teachers

The special Kiangsu summer institute for science teachers, held in 1923 at the National Southeastern University in Nanking has been briefly described in Chapter 1. Considering the short time for preparation, and also considering the fact that the laboratory facilities were not satisfactorily adequate because of the demand for them in connection with the regular science courses of the summer
session, the success of this institute was gratifying. Particularly, the experience gained was useful in shaping the plans for a more ambitious national institute planned for the summer of 1924. This institute is to run for four weeks instead of two. It is under the joint auspices of the Chinese National Association for the Advancement of Education, Tsing Hua College, and the China Medical Board. The faculty list, consisting of thirteen of the most successful science teachers in China and several distinguished special lecturers, was completed early; and the courses are being carefully planned. Originally, the attendance was to be limited to one hundred fifty members; but more than two hundred fifty applications for registration have been received. The demand for biology is so heavy that an additional section has been organized in that subject; but selection will have to be enforced, and the attendance in physics and chemistry will be limited to two sections for each, with twenty-five members to the section. Applicants who cannot be accepted for registration will be directed to the summer session classes to be held at other institutions. Intensive laboratory practice, and class conferences on both subject matter and method in science, and on methods of teaching in middle school and elementary college courses, together with inspirational and informative lectures, will constitute the daily programs. This institute promises to be very successful; and it is hoped that it will furnish experience and point the way for others. A report on this institute will be published by the Chinese National Association for the Advancement of Education, so that the details of experience in conducting it may be available to others.

The large number of applications received, and the widely representative character of the applicants, show that the demand among the science teachers for help in improving their scholarship and methods of teaching is great and widespread. The interest shown in my lectures and conferences in every city that I visited shows the
Responsiveness of science teachers. same thing. It shows that if opportunities are offered to the teachers for improving, they will respond; and it justifies the recommendation that efficient courses be provided for the science teachers of every province.

Teachers of other subjects also need help. Such provision, however, ought not to be confined to science alone. It ought to be made for teachers of other subjects, and especially for those whose subjects are most closely related to training in citizenship.

b. A Nation-Wide Coöperative Movement for the Improvement of Science Teaching

The intimate problems of improving science instruction in all its numerous phases are so many, so varied, and so difficult that they constitute a challenge to every scientist and educator who has the welfare of China at heart. Most of these problems have to be solved coöperatively by putting together the work and the wisdom of several persons.

In view of this condition, the Chinese National Association for the Advancement of Education has undertaken to lead in a national movement for the improvement of science teaching. It has published a bulletin\(^1\) describing the Department of Science Teaching, which is now being organized in connection with the association, to carry on the work. This bulletin outlines the various divisions, their organization, and the work that each is expected to do. There will be nine divisions, each under the direction of a chairman and an executive staff, consisting of a vice chairman, a corresponding secretary, an editorial secretary, and another member chosen at large from the membership of the division.

There will be divisions of Physics, Chemistry, Biology, Geography, General Science, Hygiene and Public Health, a division of Teacher Training, and a division of Science Teachers’ Clubs. Each division will consist of voluntary workers who are able and willing to work upon the problems of teaching that fall within the fields represented by the divisional names. The work of the department will be centralized under the direction of the Executive Council, which will consist of the chairman of the different divisions. The Director of Science Education of the association will be the chairman of the Executive Council. The projects to be worked out are of sufficient importance to scientific progress in China to make a strong appeal to every leader among the scientists and science teachers of China, both Chinese and foreign; and it is to be hoped that such leaders will cheerfully respond to the call for their cooperative effort.

Better textbooks and laboratory manuals are urgently needed, written in Chinese, with their illustrations and applications taken from Chinese life and conditions. Foreign texts and manuals are unsuitable. Competent authors must be stimulated and helped in writing the kinds of textbooks, laboratory manuals, and reference books that are suitable for each of the sciences. To help in getting such books written and published in the best possible form is one of the most important projects.

Another is to get out bulletins giving practical hints and helps to teachers, such as (1) suggestive syllabi of courses, with helpful comments as to how to teach the various topics; (2) lists of the best demonstration and laboratory experiments, how to make them, and how to correlate them with the topics of the syllabi; (3) lists of the necessary apparatus supplies, etc., for carrying out the experiments, and where they can be bought to
the best advantage, or they can be "homemade"; (4) to get out standard plans for science classrooms, stock rooms, and laboratories and their necessary furnishings; (5) to promote the making and use of standard tests and educational measurements in the science subjects in various grades; (6) to get out all kinds of needed helpful bulletins and lesson leaflets on nature study and agriculture for the teachers of the elementary schools, to agitate for more and better nature study, and to help the elementary teachers to study the natural objects of their own environments at first hand, so as to stimulate local activity in collection, classification, and exchange of specimens.

The Division of Teacher Training is designed to carry out investigations and promotion projects for the purpose of improving and increasing the courses and facilities offered to science teachers for perfecting their training in science and methods of teaching. It is expected that this division will work actively (1) among the higher institutions to help them in setting up the courses that are needed, and (2) among the provincial departments of education and the provincial educational associations to induce them to motivate and assist the teachers to take advantage of the courses that are offered.

The Division of Science Teachers’ Clubs is expected to work vigorously in promoting science teachers’ clubs in the cities, and district centers, helping them to get organized, and keeping in touch with them through circular letters and brief helpful bulletins.

A helpful bulletin. A bulletin telling how to organize such clubs and how to carry on the work of mutual self-improvement by means of them, together with a constitution, has been prepared and translated into Chinese. It is designed to assist in the promotion and inspiration of such local clubs.\(^1\) Much care, thought,

and discussion have been devoted by the officers of the association and others to the selection of those who have been invited to take the chairmanships of these divisions. On them will devolve largely the work of securing and motivating the workers in the various divisions. Therefore, their opportunity for constructive service to science education is very great. The chairmen cannot succeed, however, unless they have the support and cooperation of their brother scientists in their respective fields of science and education. It is hoped that every scientific leader in China may take an active interest in this movement, and that many of the ablest of them will consent to give some of their spare time to work with the subdivisions which will have the various projects in charge.

V. THE SUPERVISION OF TEACHING

There is, in China, some inspection of schools, by inspectors of the National Ministry of Education, and by the inspectors and deputies in the Provincial Departments of Education; but there is almost complete absence of anything like constructive, systematic supervision.

In America, the value of supervision of teaching by trained professional experts has been so thoroughly proved out by actual results, that in all progressive cities and counties, it is considered essential and is provided for. Effective supervision of the classroom activities is by no means universal there. In many cities and villages it is poorly and inadequately carried on; and there are whole states in which the rural schools are entirely unprovided with it; but in such states rural education is conspicuously backward. With respect to supervision, the Chinese educational systems must be classed with the systems of these backward states. One of the great problems of education in China, therefore, is related to the
introduction of an adequate system of supervision of the teaching and learning processes in the schoolrooms.

The solution of this problem begins with the principals and deans of the schools. Many of these officials do realize their responsibility for helpful supervision of the teaching and learning, and are attempting to discharge it to the best of their knowledge and ability. But most of these officers lack the training in special subjects and methods of teaching them, and the training in supervisory methods that is essential to the effective performance of supervisory work. Doubtless, also, the best of them are keenly aware of their deficiencies, and would proceed to repair them if they had the opportunity.

Most of the principals and deans, however, have no real conception of the need of supervision, and make no attempt to exercise this function.

Aside from principals and deans, there are no special officials anywhere whose duties include actual supervision. The duties of the official deputies of the commissioners of education, and the so-called district supervisors, are limited mostly to mere inspection, and even these inspections are mostly perfunctory.

To set up adequate systems of supervision, the first step must be agitation among the provincial educational associations to get the need for it clearly apprehended. The next step is for the colleges, universities, and teachers’ colleges to provide courses for the training of supervisors. These should teach the theory and practice of supervision as applied to Chinese schools, and should, if possible, provide practice in actual supervision under the direction of the professors in charge of the course.

Practice supervision can be done in the regular practice schools, and also in the public, and private, and missionary schools in the neighborhood of the college or
practice of supervision. university. The National Southeastern University has already made a beginning on such a plan in Nanking.

Courses in educational administration should stress the necessity of supervision, and outline the methods of supervisory organization. They should specify what supervisory officials are needed and what their duties and relationships should be. Provision ought to be made for real supervision by trained supervisors connected with the staffs of the commissioners of education; by principals and deans in middle and normal schools; and by trained supervisors in the village and rural districts.

In connection with supervision and training for supervision it should be remembered that the first requisite of the supervisor is a thorough and practical knowledge of just what the teacher ought to be doing in order to get the best results in the learning of the subject. Hence any one expecting to become a supervisor should first have successful experience as a teacher. Without knowing intimately the appropriate acts of a skilled teacher under the various conditions in which the teacher must work, no amount of theoretical knowledge of supervisory duties will enable one to become a helpful and effective supervisor.

Knowledge of the subjects and just how they should be taught is the prime essential for the supervisor.

VI. BETTER CONDITIONS FOR THE TEACHERS

In Chapters 12 and 21, it is shown that the salaries of the teachers of the middle and normal schools are low. It is claimed that they are inadequate. The truth of this claim is not proved; but I am strongly inclined to believe that it can be proved. Enough argument has been presented to show why I am disposed to take it for granted. The median annual teaching income of those reporting in my questionnaire is $625 Chinese money. Half the teachers who reported get less than
that and half get more; only seven out of eighty-two reporting get over $1,000. The median for the normal school teachers is about fifteen per cent higher. The elementary teachers in general get very much less. Their salary status is discussed in Chapter 10.

The point to be noted is that teachers must have a decent living and also a margin for old-age savings, for professional expenses such as books, travel, summer schools, etc. In general, teachers’ children should be possessed by heredity with first-rate mental ability, and society cannot afford to let them go uneducated; so from the standpoint of society as well as the teachers, they should also have enough additional margin to give their children college education.

The low salaries do not by any means constitute the whole of the problem. In nearly every province the salaries are two or more months in arrears. In Peking they are more than seven months in arrears. In one province, at least, payments were made partly in cash, partly in notes, which had to be negotiated at a severe discount, and partly in notes of the schools that were said to be of uncertain value. This condition is distressful to the teachers. If it continues for long it will tend inevitably to drive out the teachers who have the best initiative and ability, and will discourage the ablest young men and women from entering the profession.

Another bad practice is that of paying teachers by the hour, and employing many of them for part-time work. The effect of this practice is to make each teacher feel that when his hour in the classroom is finished his obligation to the school for that class ends with the hour. So the teachers do not spend the time that they ought to spend in preparing for their lessons,
in caring for the apparatus, and in preparing and setting up the apparatus for their experiments and demonstrations. They depend on the school servants to do this for them; and consequently it is not well done.

The teachers' time is largely consumed in going from one school to another; they do not give their entire thought and loyalty to one school; and they often load up with classes in different schools to such an extent that they have not sufficient time and strength for serving any of their classes well. Drastic reforms, therefore, are needed with regard to all of these practices.

VII. Reforms in the Curriculums

There is need throughout the school system for a continuing process of curriculum reforms and reconstruction. Chapters 9, 10, and 11 show that in this field considerable progress is being made by educational leaders, and that the recommendations for changes that are being made by the leaders are receiving official recognition. The schoolmen generally show admirable willingness to adopt the reforms that are prescribed; but to most of them, many of the advanced ideas are new, and they find it difficult to put them in practice without more information about them than is now available. Much elucidating literature on these curriculum changes, and on the new practices that are to come, is needed and ought to be prepared as rapidly as the experts can get them out. Such information should be issued in bulletins by the provincial departments of education, and furnished free of charge to all teachers concerned.

Chapter 17 of this volume contains a contribution on the curriculum problems of the middle schools. In that chapter it is assumed that the evolution of the schools of
middle grade will trend away from a system of many types of specialized schools and towards larger schools with differentiated curriculums, more like the so-called comprehensive high schools in America. Accordingly, curriculums are outlined for such differing groups as are now found in various types of schools,—such as commercial, agricultural, etc.,—as well as the conventional middle school.

The curriculum outlines in this chapter are not expected to be taken for all schools exactly as they are outlined; but are intended to be used as a basis for working out the principles that they exemplify, in accordance with local conditions.

As a part of the curriculum reforms that should be made, there should be included adequate provision for teaching morals and good citizenship, manual training and mechanical drawing, and free-hand drawing, color work, design, and art handicrafts in every middle school. The same provision should be made in all the girls’ schools, excepting that the home arts, home management, and home nursing should be taught in every girls’ school in the place of mechanical drawing and manual training.

VIII. REFORMS IN TEACHING PRACTICES
WITHIN THE SCHOOLS

In Chapters 13, 14, 15, and 16 will be found many statements and comments bearing on specific changes that need to be made in the practices of the teachers. Briefly characterized, the changes urged are these:

1. Discontinue exclusive use of the lecture method, and cut down its use till it occupies not more than five or ten per cent of the time assigned to the subject.

2. Use recitations, topical recitations, and class conference methods during the greater part of the
more discussion and recitation by pupils. time in the classroom. Require and get outside preparation. Introduce cautiously socialized recitations and supervised study.

3. In both lectures and class conferences use more experiments, and demonstrations with all kinds of appropriate apparatus, specimens, charts, and other visual aids. Practice with them until sufficiently skilled to carry them out successfully to the point of thorough exposition or logical demonstrations. Make the entire presentation a model of clear thinking. Give students more seat and blackboard practice in solving problems and demonstrating solutions.

4. Introduce individual laboratory work by the students. If much cannot be done, at least a little can. Do that little. Use all the equipment that is available, and try to get more. Raise money to buy some by giving school entertainments. If none can be bought, make some or have it made by local artisans.

5. Require students to make careful and accurate notes of the experiments they make in the laboratory or witness in the classroom. Inspect the notes frequently, and see that they are kept promptly and correctly written up. Use methods that will prevent the students from copying the notes of others.

6. The science teachers should be made responsible for keeping the apparatus in good condition and repair, and for seeing that it is stored in the apparatus cabinets in systematic order ready for instant use at any time when wanted.

IX. Education in Thoroughness and Accuracy

There are two conditions prevailing among the students as well as among nearly all classes of people, that,
Common habits of inaccuracy and lack of thoroughness.

more than any other, are standing in the way of scientific development in China. These are (1) a habitual lack of accuracy in doing things and in stating facts, and (2) the indisposition of the intellectual classes to do anything with their hands (excepting only painting pictures and writing characters). The science teachers must overcome these habits, or China will always be backward in science and technology.

Let them, therefore, insist on accuracy and thoroughness in experimental work. The Chinese have demonstrated in many ways that they excel in ability to acquire skill in motor coördinations; and that they can do things with extreme minuteness and accuracy of details in cases where they are convinced that accuracy and thoroughness are worth while. That they are inaccurate in so many things wherein accuracy and thoroughness are essential is due to the fact that in these things the necessity of accuracy has never been demonstrated to them in such a way as to convince them.

The science teachers, therefore, should constantly be demonstrating to their students the need of accuracy in scientific and technical work, both in manipulation and in thought processes, and should insist on getting it.

Also they should teach the dignity of manual labor (when done well, and for a good and useful purpose); and should insist in every practicable way that their students get shop practice, and actual skill in the use of tools. This cannot be acquired by standing around in their long gowns and watching a workman. The Chinese students of science and technology must become willing to exchange their clean gowns for overalls; and they must overcome their disinclination to soil their hands. The teachers must inculcate this principle by precept and by example. China will not have competent shop foremen, engineers, and managers, and cannot develop her industries without
This is necessary if China's resources are to be developed by the Chinese.

foreign help, until her young men learn this lesson. A foreman, an engineer, or a manager cannot successfully control and manage workmen unless he himself can do the skilled processes in which he is directing his men: and he can learn these processes only by doing them.

X. SCIENCE ROOMS, FURNISHINGS, AND EQUIPMENT

In Chapters 18 and 19 the prevailing types of science rooms are described. Faults in lighting are described and correct rules given for designing with reference to light and hygiene. The prevailing faults are: (1) the windows are too short; (2) they are shaded by overhanging eaves or outside corridors; (3) rooms are lighted from two sides and sometimes even from the front. This gives rise to cross-lights and bad shadows. The general absence of sufficient artificial lights for dark days is noted. Two other bad defects are the smallness of the demonstration tables and the scarcity of blackboard space in the classrooms. "Beaver board," made from compressed wood pulp, is recommended as the best material for blackboards in China. Lecture tables can be made at relatively small cost by local carpenters. They ought to be made by the boys in the manual training classes at no expense excepting that of the sawed lumber.

In the classrooms and stock rooms usually there is insufficient dust-proof and conveniently arranged storage space for apparatus. This is noted as one of the causes for the bad condition in which much of the apparatus frequently is found. Chapter 20 describes the apparatus equipments. It is there
noted that most of the schools have considerable demonstration apparatus, much of which is either obsolete or partly destroyed, and some of which was so badly made that it never could be successfully used. In most of the middle and normal schools, little or no apparatus for student individual laboratory practice is to be found. The great need is for apparatus for student laboratory practice. The recommendation is to build up the equipment with apparatus of this sort. Much good laboratory apparatus can be "homemade" if the school has a manual training shop and an enterprising, well-trained teacher. Since the difficulties of getting funds for the schools are so great, they should make special effort to produce homemade apparatus.

XI. SOME FINAL COMMENTS

Although the survey which has given rise to this volume had reference primarily to science and science education, it placed within the knowledge of the writer information which led him inevitably to see the science teaching problems from the background of the entire school system and the conditions under which that system is working. The unique combination of social, economic, and political conditions in which the school system has its setting are all so closely determinative of what the schools are and of what they must do to play their part in the changeful drama, that they seem to call urgently for interpretation. Science and science training must play such an important part in the future development of China that I could not evade a feeling of responsibility for showing not only how science is taught and ought to be taught, but also why it so urgently needs to be taught and taught in such a way that the people will get from the teaching what they should get and not something else; hence the attempt to interpret the historical, social, economic, and political features of the background in
their relations to the schools in general and scientific training in particular.

To the busy or hurried reader it may be said that each of the succeeding chapters is a unit by itself; and any individual chapters that are wanted may be selected and read without necessarily referring to the others.

This survey, and the special serial reports that were written for several individual cities, reveal the need for similar studies in lines other than science, especially civic education, art education, vocational education (commercial, agricultural, technical, home economics, and home industries), and the teaching of English.

Finally, I should be neither honest nor courageous if I failed to call the attention of both the foreign and the Chinese educators in China to the loss which it seems to me is being sustained by both classes of earnest and sincere workers for China by not becoming better acquainted with one another and working more together on the big educational problems with which they all are so deeply concerned. Some few of them do get together in this mutually profitable way, wherein they know each other as friends working for a common cause—the cause of better teaching; but more do not; and so much is lost to both of them.

The foreign educators have the intimate background of childhood and youth in the Western civilization from which the Chinese wish to select the best. The Chinese have the intimate knowledge of Chinese life and points of view which the foreigners must acquire in greater degree along with the language, in order to be thoroughly successful in educating Chinese students for life in China. Each can help the other to get what he lacks.
So, too, the foreigners have had long training in Western middle schools and colleges, such as but few of the Chinese teachers have had. The Chinese are aiming to improve their educational systems and practices by taking over the best that the West has to give. Why, then, should they not cultivate close friendly relations with each other by working together on common problems for the improvement of teaching facilities and methods, and solving them in the combined light of their complementary abilities and experiences.

I have talked with many foreigners and many Chinese, asking them why they do not work more together. Both parties say that they ought to do so. Both regret that they do not. I could wish nothing better for the foreign teachers than that all of them might experience as many delightful and profitable professional friendships with the Chinese as I have been privileged to enjoy. So, also, I can wish nothing better for the Chinese teachers than that they enjoy such worthy and genial friendships with the foreign teachers as have fallen to my lot during the past two years.

The Department of Science Teaching of the National Association for the Advancement of Education, and the local science teachers' clubs are two enterprises in which the Chinese and foreign scientists and science teachers can get together and work on projects of mutual interest. If they will do so, both can make a big contribution. If they do not, the success of both enterprises will be doubtful.
CHAPTER 3

THE BACKGROUND

I. GEOGRAPHICAL INFLUENCES

China, with its dependencies, comprises a compactly disposed territory, roughly in the shape of two thirds of a vast ellipse. The total area is estimated at 4,277,000 square miles, about six tenths that of the whole of South America, and one and four tenths times that of the United States exclusive of dependencies. China proper and Manchuria include a closely compacted area estimated at 1,900,000 square miles, or a little over half that of the United States. This area is separated from the rest of the Eurasian continent on the west by the vast plateaus of Mongolia, Eastern Turkestan, and Tibet, whose mountain and desert barriers have protected this populous area from external aggression on that side.

On the east, China proper is in direct contact with the great Pacific border seas, and is blessed with numerous harbors, affording abundant facilities for an extensive coastwise trade, as well as for a foreign trade already important but destined eventually to reach enormous proportions.

The population of the eighteen provinces, or China proper, is estimated at three hundred thirty-six million and that of its dependencies at twenty-five million more, making an average of two hundred nineteen persons per square mile for China proper and eighty-four per square mile for the whole territory. The Yangtze basin alone is said to support a population of more than two hundred million, or nearly twice that of the United States. Two thirds
of China’s population is said to be concentrated into one third of its area, the greatest density naturally being along the coast line and in the fertile lowlands of the great river basins. The great central plain, made up of the middle and lower basins of the Yellow and Yangtze rivers, includes about two hundred thousand square miles or slightly more than thirteen hundredths of the area of China proper. The remainder is mountainous or hilly but mostly with an abundance of fertile valleys and plateaus.

The country is generally well watered, and the soil fertile. It is estimated that eighty to ninety per cent of the people get their living from the soil. Frequent famines result from floods and droughts, most of which might be avoided by stream control, water conservation, and irrigation. Food enough for all is produced, but lack of rapid transportation facilities often makes prompt famine relief exceedingly difficult. Szechwan has a conservation and irrigation system which has been kept in repair from its inception; and in consequence this province boasts continuous immunity from famines for a period of two thousand years.

Coal is very abundant, iron plentiful, and other metals are mined in considerable quantities in many parts of the country. Modern methods of mining are just beginning to become established, but both intensive and extensive development of the country’s great mineral resources, which for the most part remain only partially explored, must await the advent of more and better transportation facilities.

Abundant forests still remain in the south and west, in the mountainous provinces of Yünnan and Szechwan and in Manchuria; but though China in general is no more treeless than many of the American prairie states, her hills and mountains for the most part have long been totally denuded of trees excepting the noble groves surrounding the ancient temples that nestle here and there in the mountain valleys or crown the crests of the
hills. In many provinces, more or less sincere and intelligent attempts at reforestation are being made, but as yet there is nothing in evidence which approaches the successful efforts at reforestation that one may see in some other countries.

II. THE HISTORICAL SETTING

Due both, perhaps, to her geographical separation and the inherent disposition of her people to attend to their own affairs and leave others to do likewise, China has enacted a long and independent history, undisturbed until recently by foreign complications and world politics. Although torn by civil wars among ambitious generals and harassed by robber bands from within and barbarous tribes from without, the great body of the people through more than forty centuries have pursued the ways of peace and industry, from which they have turned only after long intervals to put down bandits or to subdue invaders or to rebel against corrupt and decadent princes and overthrow them. Among their many rulers were some of the wisest and most beneficent,—men of intellect as well as power. Under such monarchs the people prospered, menacing barbarian tribes were subdued and annexed as dependencies, and literature and the fine arts flourished. These periods of flowering were separated by long intervals in which civilization was static; but large bodies move slowly, and these static periods, though longer, were not unlike the Middle Ages in Europe, periods of incubation rather than stagnation.

Twice in periods of official corruption and governmental disorganization has China been conquered and overrun by barbarians from the north; but as the English absorbed their Norman conquerors, so the Chinese absorbed the Mongols and the Manchus. Dynasties rose and fell, unscrupulous politicians and militarists fought and plotted and drove each other out, fanatical hoards of Taipings and Boxers had their disastrous innings: but the patient
toilers stuck to their plows, their looms, and their anvils; the merchants bought and sold; the artists and craftsmen continued to produce their marvelous treasures; the scholars studied and wrote. Even at times when the country was divided as it now is and was kept by rapacious feudalists in a state of turmoil and political demoralization, the scholars of China have produced essays and poetry and novels of lasting value.

As the ocean depths remain calm and peaceful while the storm waves lash above them, pitching the flotsam and jetsam to and fro, so the great body of this democratic people maintained its stability and coherence while the storm waves of official intrigue and military strife rolled and broke above their heads.

In the reign of the famous Ch’ien-lung, about a hundred fifty years ago, China had pushed her boundaries to the widest extent that they have ever reached; and it is said at that time to have been the most prosperous, most contented, and best governed nation in the world.

Up to then, the people had few contacts with the civilization of the outside world; and there was little opportunity for those exchanges of commodities, of culture, and of thought through which Western nations were reacting on one another. From the Han dynasty on, there was a limited caravan trade with India and Europe, which received an immense impetus after the return of Marco Polo and the publication in Europe of his accounts of the wealth of China. It was not until early in the sixteenth century, however, that European trading vessels began to come to Canton and Macao. Between these ports and the Western countries there arose a mutually profitable trade, which, during the three centuries following, grew to large proportions; but almost nothing of geographical knowledge and of the methods of the physical and natural sciences filtered into China from the West. She did not within herself originate scientific methods of observation, experiment, logical analysis, and problem solving, in connection with
the materials and forces of nature; though there were not wanting scholars of genius who consistently applied scientific methods of literary research and criticism to the ancient manuscripts and monuments.

The failure of the Chinese to apply the scientific methods to the development of their vast natural resources and their intricate economic and social problems is one of the most significant factors related to her present condition and future development. I venture the suggestion that the cause of this failure in China has been and is economic slavery caused by overpopulation, as physical slavery was the cause of like failure among the ancient Greeks, and of the retardation of scientific development in the former slaveholding areas of the United States of America. Science and inventions never flourish and bear fruit abundantly and beneficently where human life and labor are made cheap and where manual skill and industrial processes are despised by the intellectual and ruling classes. This is a truth which even the most advanced nations have only just begun to grasp,—for has not the industrial revolution in every country brought about injustices, discontent, and disastrous strife? This is not the fault of science, but is the fault of those who, because of their financial resources, their military, political, and intellectual power, and their lack of intelligent conscience, have been able unscrupulously to appropriate to themselves, not only their own share of the wealth and goods resulting from increased production, but also a large part of the shares that rightfully belong to the laborers and the public. The increased production brought about by the application of science to industry tends to make the rich richer and to make the poor no better off but more dangerously discontented, and to make all classes more reckless and extravagant, unless the true altruistic spirit of science, conceived in terms of the brotherhood of man, controls the organization of finance and the machinery of distribution.
The Background

For this reason it is perhaps well for China and for the whole world that her backwardness in science has delayed the beginning of her industrial revolution until a time when she can learn from the industrial mistakes of the Western nations, and may, if she chooses, find her new economic structure on the firm ground of justice and fair play for all classes. The hope for China lies in her present opportunity to reject the soulless and materialistic economics of the nineteenth century and to appropriate and adapt to her own conditions and temperament the principles and methods of brotherly co-operation in industry which are now being so successfully applied by many enlightened individual organizations in Europe and America. Thus, if she will, she may develop her immense resources and apply them for the physical, intellectual, and spiritual uplifting of all her people, instead of allowing them to be exploited and expropriated for the selfish purposes of any predatory class, either native or foreign.

After the passing of Ch‘ien-lung, the Manchu dynasty began to decline, and went from bad to worse until its final overthrow by the Revolution of 1911. During this dynasty, foreign trade was not encouraged, yet it increased in volume and importance, and became so lucrative that it aroused the cupidity of the Western nations and led to international rivalries and contentions for advantage in the economic penetration of the country. Thus with the seizure of Hongkong by Great Britain and the opening of the southern ports, to concessions and foreign trade, there began a series of aggressions by Britain, France, Japan, Russia, and Germany, which for a time threatened the dismemberment of the country and the annihilation of its sovereignty.

These encroachments have brought many evils in their wake, the worst of which is the opium traffic with its moral and economic waste and its trail of official corruption; but they have also resulted in much good,
which must not be overlooked. The building of nearly seven thousand miles of railways and many steamboat lines, the opening and operation of mines and factories with modern equipment and scientific management, the enforcement of honest administration in connection with the maritime customs and other interests under foreign control, and the introduction of modern sanitation and other improvements within the foreign concessions at the treaty ports have been of tremendous benefit in themselves. Perhaps, however, they are of even greater national value as educational exhibits, demonstrating to the Chinese people the kind of progress that they themselves can make through the wise selection and adoption of Western scientific and technical methods, honest financing, and efficient management.

More creditable to the Western nations than their political encroachments and military aggressions is the history of their Christian missions and later of the international Y. M. C. A. and Y. W. C. A. These beneficent agencies have labored unselfishly to help the Chinese people by teaching them the best in religion, science, literature, sociology, industrial organization, and government that the Western civilization has brought forth. They are spending millions of dollars every year in medical and teaching service, in famine relief, and in other work for the Chinese people, all of which is a gift of pure good will. Their thousands of schools, colleges, churches, hospitals, and publications, reaching hundreds of thousands of youth and adults, are enabling the people to develop critical judgment in selecting and combining the best elements of the ancient Chinese civilization and the dynamic civilization of the Occident.

More and more as the years go by, the graduates of the Christian schools and colleges are coming into positions of prominence and trust in the economic and political life of the nation, and are giving the best of their thought and energy in the service of their country. Some of the
most highly trusted leaders in China are graduates of these Christian colleges; and they are trusted because of the qualities of character and behavior which they acquired under the teaching of these institutions.

Whenever, in times of storm and stress, officials or people have turned to the Christian missionaries for advice and help, wise advice and efficient assistance have been freely forthcoming.

The spectacle of the Western peoples with one hand constantly wringing humiliating concessions from the Chinese government, and with the other hand freely giving of the lives and treasure of their citizens to help the Chinese people in realizing their great possibilities is hard to comprehend. However, it becomes perfectly intelligible when one comes to understand that economic imperialism with its diplomatic and military aggression is dictated by industrial adventurers, politicians, and militarists, while the service of the missionaries is the expression of good will and unselfish helpfulness extended by the plain peoples of the Western nations. These citizens, like the plain people of China, are better than their exploiters, politicians, and militarists, whom they also, no less than the Chinese, often find it difficult either to control or to inoculate with conscientiousness.

While Western learning, Western ideals, and Western methods of organization were spreading as leaven from the missionary centers and filtering in through the treaty ports, there was also a regenerating influence which sprang from native sources. Eminent Chinese scholars and publicists were agitating for political, social, economic, and literary reforms. The Chinese renaissance, which began in the last years of the Ming dynasty, had been gathering momentum, until after three hundred years it broke through the crust of conservatism.

The calls for reform received an impetus from the defeats sustained by the Chinese government at the hands of France in 1885, and of Japan in 1895. A half-hearted attempt was made to introduce Western learning and modern armaments, which could not by
Beginnings of any means be successful without a thorough reorganization of both the political and economic structures.

Emperor Kuang-hsü in 1898 gathered about him some of the ablest of the reformers, and attempted a program of reconstruction, providing for a modern educational system, the development of railways, and the introduction of Western industrial methods; but the reformers were too few and the reactionaries too strong. The young emperor was imprisoned, his advisers assassinated or driven into exile, and the Empress Dowager remounted the Dragon Throne. Then came the Boxer rebellion, whose fury the empress and her clique succeeded in turning against the foreigners and all their works. Inevitable defeat came speedily to the Boxers and also to the imperial troops from the hands of the foreign allied forces. The empress fled, but subsequently was recalled, and an indemnity of a third of a billion was imposed upon China by the allied governments.

The disaster to their government eventually turned to the advantage of the Chinese people, as many of her previous misfortunes had done. First, through American diplomacy the Boxer scourge brought forth the policy of the "Open Door," which, though it has been lightly regarded in some quarters, is founded on international justice and had to be reckoned with. Happily this policy has been confirmed in the recent treaties of the Washington Conference; and an international conscience has at last crystallized which bids fair to assure to China her integrity and to protect her from further aggressions.

A second consequence of great significance was the return by America of the excess in her share of the "Boxer Indemnities," which China has wisely invested in "American scholarships." As a result of this agreement between the two governments, hundreds of the flower of Chinese youth have been sent to study in American universities and are returning with a knowledge of the modern physical, biological, social, and political sciences, and an appreciation of the best phases of American ideals and
national life. Happily, indications are not wanting that other nations may enter into similar agreements with China, with the result that Chinese students may resort to the universities of other countries in much larger numbers than heretofore. Such an extension of indemnity scholarships, coupled with more careful selection, control, and guidance of the recipients, and more effective arrangements for utilizing their abilities in education, in government service, and in the technical, financial, and mercantile corporations, would in a few years work miracles in the evolution of the new order.

Thirdly, the scientific and reform movement, which all along had been accumulating momentum, was given an impulse by the Boxer disaster and was further accelerated by the revelation of Japanese power and efficiency when Japan administered a decisive defeat to Russia in 1905. Through her rapid assimilation of Western science and Western economic and military technology, Japan in the short space of thirty-five years had grown from a small feudal state into a first-class world power. This demonstration of the ability of an Asiatic people to maintain a footing of equality with the Western powers was complete and convincing. The reform movement in China gathered volume and swept the country in a tidal wave. The empress, who had been the arch-reactionary, executed an about-face and assumed the rôle of chief reformer. No doubt she was sincere to the extent of her knowledge and ability. Elementary and middle schools, normal schools, colleges, and technical schools were established in great numbers, built, equipped, and operated under government supervision, and modeled after those of Japan. Thousands of students now flocked into Japan, many of them seeking a short cut to Western learning and official preferment; others to fit themselves as speedily as possible for positions in the new schools and others to train themselves for technical and industrial pursuits of the new order.
The Civil Service Examinations, which had functioned almost continuously for a thousand years, were summarily abolished. As a selective and standardizing agency in the educational and official fields, the examination system had constituted one of the chief causes of the neglect of Western learning and the conservatism of both scholars and officials; but it was founded on a wise and workable principle; and it should have been reformed and developed on modern lines. It seemed, however, to have been naïvely expected that the new schools would immediately turn out an adequate supply of capable men, equipped with the modern learning, who would at once become competent officials.

In the very year of the Japanese triumph, an imperial commission of Chinese princes and officials was dispatched to Europe and America to study the forms of constitutional government; and in 1908 steps were taken towards setting up provincial assemblies and a parliament.

It did not regenerate official life.

These changes in form, however, brought little change in substance. Corrupt and incompetent officials remained entrenched. They had not gained in knowledge and efficiency. They had experienced no change of heart. Into this situation, in 1911, the Revolution broke prematurely. It had been brewing for several years, but young China was not yet sufficiently strong in numbers and experience to build up a stable and efficient government in the place of that which had been overthrown. So though the forms and titles of government are changed, the officials whom the Revolution unseated are for the most part again in the saddle.

The Republic is not as yet a success, but it has come to stay. Twice have attempts been made to restore the empire; but the plotters were promptly overthrown. The Chinese have done with monarchs. They will have no more of them. This good-natured, persistent, and intelligent people has set itself to the task of achieving a stable republic.
Though storm clouds gather and break and difficulties beset her path, China is making progress, and will not turn back. In time, she will again be a united people under a firm and stable republican government. Ten or twenty or thirty years may be required to bring order out of the present chaos, which is in reality more superficial and apparent than fundamental and real; but what is a generation or two in a history of over four thousand years!
CHAPTER 4
THE SOCIAL FACTORS

I. OLD CONDITIONS AND NEW IDEAS

In China of to-day we see a nation of four hundred millions of people with a government republican in form but yet essentially feudal in effect, and a society showing every phase of development from the primitive pastoral culture of Mongolia and Kansu to the modern factory community in Wusih and Shanghai—a vast complex of medieval life, seething and bubbling with the ferment of modern ideas and aspirations, and permeated in the cities with modern mechanical appliances.

"The changing Chinese" and "A moving picture of all history" are apt phrases which picture the drama that is being enacted by the dense population of this vast country with its rich and varied natural resources, actual and potential, and its almost unlimited man power. Here is a people with a genius of patience, industry, and common sense, an essentially democratic attitude of "live and let live," a keen appreciation of beauty and goodness, a deep and abiding love of reasonableness and peace and order, and an average of native intelligence as good as that to be found in any country in the world. But it is a people that has not yet come to understand the ways of modern science and the arts of modern economic organization. Real understanding of science and scientific organization means ability to use them beneficently. The Chinese people have not learned to use science in such a way as to promote general comfort and health, to protect themselves against floods and famines, to develop their immense

Science as the servant of mankind.
economic resources, and to attain to that state of political stability and efficiency which would enable them to take among the leading nations of the modern world that position of importance to which their resources and potentialities entitle them.

This backwardness of the people is due not to any inherent lack of ability, but rather to the general lack of efficient scientific training, and to the prevailing lack of knowledge and sense of individual responsibility, concerning civic obligations and public service. The removal of this handicap must come through better education more widely diffused.

There are many social conditions which militate against progress through education, and against the improvement of education itself.

II. OVERCONCENTRATION OF POPULATION

The first condition that impresses the student of affairs in China is the abnormal concentration of population. Large areas are highly cultivated but overpopulated to the verge of want, and other immense areas are undeveloped and undercultivated because of the sparseness of population and the lack of available expert knowledge and capital for the efficient and profitable exploitation of their vast potential resources. Thus in Shantung the population is estimated at 528 per square mile; in Chekiang, at 463; in Kiangsu, 448; in Honan, 376; while in Kansu, it is 40; in Manchuria, 41; in Sinkiang, 4; in Mongolia, 2; and in Tibet, 12.

In many of the thickly populated provinces there are mountainous regions that are sparsely populated, and their mineral resources are relatively little developed, while the population is densely crowded in the rich and fertile basins of the rivers and lakes. In the large undeveloped provinces and dependencies, excepting Manchuria, there are extensive desert areas which probably never can support large bodies of people; but there are also immense areas
that can be developed to support large agricultural, mining, industrial, and pastoral enterprises. As to Manchuria, it is regarded by experts as a region of immense resources for timber, mining, manufactures, live stock, grain growing and milling, and general agriculture.

This concentration of population in the rich agricultural lands, which have been under cultivation for more than two thousand years, while there remain under Chinese control vast unpopulated areas rich in potential wealth and capable of supporting large populations, is a social fact of immense significance. The spirit of exploration, colonization, enterprise, adventure, is lacking among the people. They must develop it through knowledge of geography, natural science, and economics, through propaganda, through example and demonstration of the rewards of enterprise, and through breaking down the barriers of outworn customs and ancient prejudices. They must either do this or learn and adopt birth control: otherwise ultimate starvation inevitably awaits them.

There are many ancient customs and beliefs that tend to perpetuate and intensify this condition of overpopulation, among which three call for special attention.

One is the widespread ancient doctrine that a man must have as many sons and male descendants as possible in order that they may make offerings and sacrifices for his departed spirit, and preserve the solidarity of his family.

Another is the custom of early marriages arranged by grandparents or parents without reference to the will or desire of the couple most concerned.

The third is the custom of keeping the children at home, instead of encouraging them to go out and seek their fortunes elsewhere. This results in division and subdivision of the family land until the holdings become too small to support those who are living on them. This same principle applies in the small shops and commercial businesses in the cities. There are so many sons and
relatives to be employed in the family business or supported by it that it cannot expand rapidly enough to bear the strain.

Thus these ancient customs tend directly towards overpopulation, congestion, and undercapitalization, and thus in spite of industry, sobriety, and frugality, they tend inevitably towards a general reduction of the scale of living to the minimum level of bare subsistence.

These conditions in themselves tend to destroy enterprise and initiative and to make local support of modern education practically impossible.

Poverty, the scarcity of land, the economic wastes caused by the opium traffic, and the hopeless cheapness of labor, resulting from the conditions mentioned, are efficient causes if not the main cause of banditry, which has existed for ages in China as it exists to-day. Overpopulation combined with the custom of placing loyalty to the family above loyalty to the country, or loyalty to any other principle whatever, constitutes one of the chief causes of bribery, official corruption, and the custom of "squeeze," which is one of the chief impediments to social and economic progress as well as to political decency and stability.

III. LACK OF ADEQUATE TRANSPORTATION FACILITIES

A second striking feature of the social situation is the distressing lack of transportation facilities. Excepting in the largest cities and treaty ports, transportation is medieval or even primitive. Goods are carried along footpaths, or narrow mud roads, or rough paths paved with large stone blocks, nearly always in bad repair. They are carried by coolies on shoulder sticks or on their backs, or by pack trains of donkeys, ponies, or camels, or on wheelbarrows, or on two-wheeled carts drawn by coolies, ponies, donkeys, or oxen, and sometimes by a mixed team of animals and men who toil along the road together.
Passengers travel on the backs of donkeys or camels, in carts or wheelbarrows, or in sedan chairs borne by coolies or donkeys. In many of the cities thousands of rickshas are used, but in others the streets are too narrow for these; and passenger traffic must be on foot or in sedan chairs. This is particularly true of cities like Chungking, where the streets contour the hills at different levels, and the travel from street to street must be accomplished by climbing or descending stone stairways.

Since as yet there are less than seven thousand miles of railway in the whole of China, and electric cars, automobiles, and horse carriages only in the largest cities and treaty ports, and since the extensive canal system of the country has not approached modern standards but has in fact deteriorated, transportation is handicapped. This condition tends to limit traffic and intercommunication, checks the interchange of needed commodities, and keeps the people in a state of medieval culture.

In spite of these obstacles, goods are constantly moving by such avenues of transportation as are available, mails regularly reach nearly every part of the country, and telegraph and telephone facilities are fairly widespread and efficient. Steamer traffic on the Yangtze and along the coast is extensive and in the main well managed.

Both the amount of goods and the number of passengers carried are astounding.

All the treaty ports and larger cities and many of the smaller ones have their electric light plants. Bicycles are numerous in most of these cities. Motor cycles and automobiles are common in Peking and the treaty ports; and airplanes fly over these cities on almost any fair day.

IV. RAVAGES OF FAMINE AND DISEASE

A third social condition that strikes the observer is the appalling destruction of life by famines and disease.
The frequent and disastrous famines which appear in parts of China, while in other parts there is plenty of food and a surplus, result from three causes, all of which can be partially removed with the aid of scientific knowledge, of honest and efficient government, and of accumulated capital. These causes are drought, floods, and inadequate facilities for rapid transportation. Reforestation and river conservancy projects can do something towards mitigating droughts and much towards preventing floods; railway, road, and waterway development can do the rest; and the accumulation of capital for providing these remedies will result from the surplus of manufactured products that will accumulate from the fast approaching industrial reconstruction, if it be scientifically guided and honestly carried out, and if it be safeguarded by honest and efficient government.

The ravages of diseases and epidemics of all kinds can be mitigated and many of the diseases, as we well know, can be stamped out entirely by adoption of modern sanitation and scientific preventive and curative methods of Western medical practice. But these things also require pure water supply, sewerage and sewage disposal plants, paved streets, sanitary homes and business places, hospitals, open parks and modern medical colleges—all of which can be purchased, but only through the expenditure of large amounts of accumulated or potential capital.

In China as yet, modern municipal development and sanitation must be spoken of in the future tense. Some Chinese cities like Nantungchow and Hangchow are making creditable beginnings. The Legation Quarter of Peking and the foreign concessions, especially in Tientsin, Shanghai, Hankow, and the beautiful summer resorts, Peitaiho and Kuling, furnish excellent exhibits for education along this line; but these are only scattered seeds in a vast, untilled field. Medical colleges, hospitals, and clinics established under foreign boards have had an
encouraging development. Peking has a research medical college and hospital whose reputation is world-wide, and whose graduates will set the future standards for China at a high level. There are in Peking and inland cities, as well as in treaty ports, hospitals and medical and premedical schools, both foreign-managed and Chinese-managed. These have been growing in numbers and efficiency during the past ten years; yet they are but drops in the bucket compared with the needs of China.

The people are naturally vigorous and resistant; and were their living conditions always and thoroughly sanitary, they would be very generally strong and healthy if well nourished. One of the marvels of the country to the stranger is the apparently small proportion of the poorer classes who appear to be undernourished in spite of the fact that they have so little to spend for food. For getting a living out of little they exceed any people in the world. In economic competition no other race can overcome them. The middle and lower classes, excepting the proportion who are addicted to the world-wide vice of gambling, are frugal and saving. Nothing goes to waste in China. Materials are more costly than labor; and everything from used tins and packing boxes to broken bits of glass and street sweepings has a commercial value and is utilized. Every rubbish and ash heap is picked over by hand. To study the methods devised by the Chinese, of utilizing countless things that go utterly to waste in America, is one of the most fascinating occupations for the foreign visitor.

Though China has her wealthy and prosperous classes, the condition of the great majority is a matter of deep concern. In spite of their industry, millions of them are barely able to keep their incomes at the subsistence level, while there are many who are not able to do so well. There are many districts in which the farmers on their
small holdings are able just to feed themselves and their families during the spring, summer, and fall, and save enough seed for the next season’s planting. In the fall, they store their seed and food for the spring, close up their houses, and whole families go to the cities to find what subsistence they may at the soup kitchens or by begging on the streets. It is noteworthy that during their absence their humble hoards are never molested by bandits or thieves. Often these poor farmers do not have sufficient garments to go around, and some of the family must remain half naked, huddled together in a vain attempt to keep warm while the others go out to beg. Fuel is costly, and mostly beyond the reach of these unfortunates. We have the testimony of social workers that children have been seen picking cigarette stubs and bits of combustible material from ash heaps to be used in making a pitiable fire. Obviously these families are very different from the professional beggars who frequent the streets, half naked in tatters and sackcloth for the purpose of creating undeserved sympathy.

These conditions cry out for the scientific reorganization of industry and philanthropy. In the “Social Survey of Peking” by Gamble and Burgess (George H. Doran Company, New York) the initial steps towards reconstruction in methods of philanthropic effort in China are clearly pointed out. The survey shows the need for scientific study of these conditions in order first to gain complete knowledge of the facts, second to plan effective co-operative effort, third to organize and motivate all available people and agencies for carrying out an adequate program. A determined and intelligent movement to remove the causes through social reconstruction will do more than scattered efforts to relieve individuals. There is plenty of evidence that the best elements of Chinese leadership are rapidly coming to this point of view, and are ready to cooperate with any who can clearly point out the way.
V. ABILITY FOR COÖPERATION AND ORGANIZATION

That the Chinese people have great ability for coöperation and organization is shown by their guilds and chambers of commerce. The guilds are highly democratic. They include all the masters and all the workmen. Each has a vote in the election of officers and the adoption or revision of rules. In countless coöperative and democratic ways the guilds settle disputes and keep their members out of the courts, relieve distress, and promote the general welfare of those within the organization.

In the chambers of commerce, a similar spirit of democracy and coöperation prevails. These chambers are made up of the representatives of guilds and independent business concerns, and are closely analogous to Western chambers of commerce, but are given more government recognition.

These guilds and chambers of commerce, together with the students' organizations, which also are essentially democratic, constitute an immensely significant social factor, because of their great possibilities with relation to the formation of public opinion. These three types of democratic organization are found almost everywhere in the country; and when they unite, as they did on the Shantung question in June, 1919, and organize a strike or boycott with the weight of public opinion behind them, they have the power to drive out corrupt or offending officials and compel even the Peking Cabinet to change its policies.

The incidents of the 1919 strike and subsequent boycotts go to show in the most convincing manner the tremendous power of public opinion in China when organized and united on a large and vital question and a definite and feasible program; and they also point out clearly the ways and means by which public opinion can be educated and focused against an evil or in favor of a good. In the present order of misrule and disturbance, this is the most significant of all the encouraging
social factors that the hopeful student of Chinese affairs can discover.

VI. THE RENAISSANCE MOVEMENT

The renaissance movement already mentioned is an agency of rapidly growing potency in arousing and clarifying thought on national problems and directing the streams of public opinion into a common channel through the stimulation of logical thinking. As yet it has been effective mainly in the intellectual field. Aside from the popular uprising and the students' revolt on the Shantung question, for which it was largely responsible, it has not accomplished much in the political and economic fields; but it has profoundly affected the attitudes and habits of thought of large bodies of Chinese intellectuals concerning fundamental principles in all the fields of human action.

This movement, confined at first to the production of poetry, stories, dramas, historical writings, and novels in the vernacular Mandarin as opposed to the classical, or Wèn-li, began long ago, but did not begin to acquire coherence and momentum, or to provoke much active discussion until the seventeenth century. During the last decade of the Manchu dynasty, its leaders began to agitate for political reforms, as well as for literary freedom, with the results that previously have been mentioned. A great regenerative force.

The results were superficial and therefore not effective, but in 1911, this movement conspired with other causes to bring about the political revolution; and within the following decade the literary revolt was directed with such energy that it culminated in 1919 in the literary revolution. The ancient classical language was declared to be a dead language, unfit adequately to express the thoughts, feelings, and aspirations of a modern people. It was shown that the modern Mandarin (Pei-hua), the most widely spoken tongue in the country, had produced "a literature more extensive and varied
than any modern European language had ever possessed at the time of its establishment as a national language.” It “is the culmination of over twenty centuries of linguistic revision and reform, and is consequently by far superior to the long dead classical language.”¹ Classicists and reactionaries waged a bitter fight against the group of teachers and students in the Peking National University, who were leading the revolt. The insurgents stood their ground. When the country rose in protest against the Shantung decision of the Paris Peace Conference, the university promptly assumed the leadership in the movement against the alleged pro-Japanese ministers. After a stormy and riotous struggle, lasting through several months, in which the revolting students were backed up by effective strikes of students and tradesmen in Shanghai and elsewhere over the country, the government was obliged to yield. It dismissed the offending ministers, apologized to the students whom it had jailed, and conceded the right of the students to lecture in the streets. Obviously the students got beyond faculty control, and went too far when they committed riotous acts against the offending officials; but the country placed the blame upon the government, because it prevented the students from using peaceful methods of protest; and doubtless the country was right. The outcome of the students’ movement was a tremendous increase in the prestige of the university, and a country-wide acceptance by the students and intellectuals of the leadership assumed by the progressives of the university faculty and their student followers. The magazines, pamphlets, books, and translations of Western philosophical writings, which they were putting out in the vernacular, were widely circulated and eagerly read. Magazines in the popular language

sprang up in great numbers everywhere. Since 1919, the number of these magazines has increased to over four hundred. They are largely modeled after the three original publications of the renaissance leaders, the *New Youth*, the *Weekly Review*, and the *Renaissance*. The common end for which these periodicals work is stated by Dr. Hu Shih, the recognized chief of the renaissance leaders as “a critical evaluation of the old civilization of China and critical introduction of new ideas and ideals from the West.”

By 1920, the newspapers had fallen into line; and Pei-hua had become the official language for the school textbooks.

A great stimulus was given to the renaissance movement, especially in relation to educational and social thinking, by the visits of such eminent philosophers, publicists, and educators as John Dewey, Bertrand Russell, and Paul Monroe, who lectured in Peking, Nanking, and other strategic points. Their lectures were translated, and widely printed and discussed in the magazines and newspapers, and have had a profound effect upon the social and educational thinking of young China. The influences of Dewey and Monroe especially have led to much thoughtful discussion and experimenting in the schools, even in places that were not personally visited by them; and throughout the country the interpretations of Russell have helped the intellectuals to a better understanding of the Chinese civilization and those elements in it which are of basic and permanent worth.

According to its platform the aim of this movement is “to remake civilization” through “democracy and science,” and the “transvaluation of values.” The platform calls for a reconstructive critical attitude towards ancient customs, beliefs, and methods of procedure, for the purpose of rejecting those which have no present and future value or of modifying them or substituting better ones.¹

¹ See Gamble and Burgess, “Peking, A Social Survey,” Doran, N. Y., 1921, pp. 428, 429.
In the reconstruction of national affairs three steps are called for: (1) careful arrangement and systematization of these former customs; (2) careful investigation of each theory and idea as to what influence it would have if promoted; (3) use of the scientific method of exact and careful investigation.

"The problems proposed for investigation include,—
"(1) Social:—Social reconstruction, emancipation of women, emancipation of men, Confucianism, educational reform, marriage, the relation of father and son, economic problems, labor problems.
"(2) Governmental:—The rule of the people, anarchy, internationalism.
"(3) Literary:—The literary revolution, the problem of the national spoken language, novels, the languages of other nations, the abolition of the use of the ancient Chinese literature, the theater."

In the words of Dr. Hu Shih, "It is no slavish worship of the Western civilization that we are witnessing, but the rebirth of an old civilization under the influence of a new impulse and a new attitude, which direct contact with the ideas and methods of the modern world has produced."

The significance of the renaissance movement, so wisely conceived and so sanely guided, can scarcely be overestimated. Probably it is in this movement more than in any other source that we shall find the chart, compass, and steering wheel for guidance of the forces of public opinion; and it is in public opinion, energized, educated, welded, and directed by wise, unselfish, and patriotic leadership, that China must center her hopes. Through this just instrument of democracy, and not through dictatorships, whether of militarists or capitalists or proletarians, she will ultimately steer her course out of the maelstrom of strife and disorder into the open sea, and proceed in peace and security on the route of progress.
CHAPTER 5
THE EDUCATIONAL SITUATION

I. THE MOVEMENT AGAINST ILLITERACY

THERE remains to be mentioned one other serious obstacle to the establishment of real democratic control and better social and economic conditions in China. This is the almost overwhelming preponderance of illiteracy, which is estimated around eighty per cent.

Fortunately, the whole country is awakened to the imperative need for some kind of action looking towards remedies for this condition. The people themselves are hungry for education, and large numbers of them grasp it eagerly when the opportunity is presented them. The chief obstacles to be overcome lie (1) in the large number of illiterates, and the large proportion that these are of the whole population; (2) the great difficulty of mastering the immense number of ideographic characters, each of which represents a single word; (3) the poverty of the people themselves, and the present impossibility of accumulating and commanding sufficient funds to establish a system of compulsory universal education.

In spite of these obstacles, serious attempts are being made to attack the problem of illiteracy. Primary schools are widely scattered and increasing in number.

In 1922–1923, there were enrolled in government, private, and Protestant missionary schools, 6,819,486 students, 96.72 per cent of whom were in the seven elementary grades. The total number of schools (all missionary schools excepting colleges, not included) was 177,751; and of these, 167,076 were of lower primary (first four grades), 10,236 of higher primary (next three grades), and 439 were elementary vocational schools.
In 1906, there were less than half a million students in government schools and private schools under government supervision.

In 1912, there were nearly three million, an increase in six years of approximately five hundred per cent. In 1922–1923, their number had increased to more than six and a half million, an increase during the past ten years of about three hundred thirty per cent.

In 1922–1923, there were 182,804 students reported in secondary vocational schools, middle schools, normal institutes, and normal schools, and 34,880 in colleges. These include private and Protestant missionary institutions.

As a feature of the student movement, students in the middle schools, normal schools, and colleges have organized schools for poor children,—which they have administered, taught, and financed through their own voluntary efforts. In almost every large city visited in northern, central, and western China, one or more such schools were seen in operation. No reliable statistics are available concerning this type of school; but in Peking alone, in 1923, the students of sixteen middle schools and higher institutions maintained nineteen such free schools for poor children and illiterates, enrolling a total of 2,326 pupils.

We can scarcely commend too highly the spirit of enterprise and social service that motivates the students to give of their time and their pocket money to carry on these schools for the poor. They are rendering a genuine constructive service, important in the building of the new China. It benefits the poor children and their families individually; it benefits the Republic by giving many of the submerged class the means of becoming self-supporting and useful citizens; and perhaps most important of all, it gives the students who operate these schools actual experience and practice in cooperation for carrying out activities for the public service. The habits thus formed of cooperation for social and public service, and the skill thus gained in the processes of organization,
administration, and supervision of collective activities are going to qualify these students for larger public services in the social, economic, and political evolution of the days to come.

Thus far no account has been taken of the old-style traditional private schools for the study of the classics, which in central and southern China are estimated to enroll at least as many students as are found in the more modern type schools. It is probably safe to say that to-day more than ten million of the say seventy-five or eighty million children who ought to be in school are getting some kind of instruction, and will not grow up totally illiterate.

So much for educational endeavor through the schools; but government and private educational enterprise goes beyond the schools and reaches out for adults and all those whom the established schools do not reach.

II. EDUCATION OUTSIDE THE SCHOOLS

Extensive attempts have been made to reach adults and youth outside the schools by means of lectures given in regular lecture halls and by itinerant lecture groups. The government program for such work, started in the early years of the Republic, was most comprehensive, and was taken up enthusiastically by many of the provinces. In 1919, there were 2,139 lecture halls in the various provinces, and in 1915, there were lectures given by itinerant groups in temples, markets, schools, and in the open air in 738 places in the scattered towns and villages. These do not include the lectures given by students on the streets and in their home towns and villages during vacations.

Lecture outlines and topics for discussion were supplied by the Ministry of Education. Lectures were to aim towards instilling patriotism, encouraging a law-abiding spirit, emphasizing public virtue, spreading common knowledge, instilling aesthetic appreciation, encouraging industry, improving physical culture, and emphasizing public hygiene; and they were to take advantage of such special
occasions for lecturing on timely topics as the birthday of the Republic, floods, epidemics, etc. Lecturers were required to qualify, and special training schools for them were provided for.

Recent disturbances have doubtless retarded the development of this lecture system; but it will probably be revived in time or something more thorough and better organized will take its place. It is a movement that should not be allowed to die.

An agency of very great influence in the lecture field is the lecture department of the Y. M. C. A., which sends lantern slides, moving pictures, and prepared lectures to its centers throughout the country. It has sent out such eminent speakers as Dr. David Yü, Dr. John R. Mott, and Dr. Sherwood Eddy, who have lectured on Christianity and social subjects to large and thoughtful audiences in various parts of the country, and Professor Robertson, whose popular experimental lectures on wireless, the gyroscope, aeronautics, relativity, etc., are eagerly heard and have had an immense influence in spreading sound ideas about science.

These Y. M. C. A. men have had a great and helpful influence among the young Chinese in making clear the distinction between superstition and the Christian religion by showing that science, although opposed to prejudice and superstition, is not antagonistic to the teachings of Jesus, out of which the best and most serviceable ideas of Western civilization have grown. How much this may mean to the earnest and inquiring young men and women of China, it is impossible even to guess; but that its effects will be far-reaching is scarcely possible to doubt. It would indeed be disastrous to China and to the whole world if in appropriating Western science her people should also adopt materialistic industrialism and militant nationalism as the philosophic bases for their self-development. There is need, therefore, in China, as in the rest of the world, for widespread teaching of a new Christian philosophy that insists on universal brotherhood as the fundamental principle of all human interactions,
and a philosophy that recognizes science as a means of freeing men's bodies and training their minds not for ease and indulgence, not for industrial and military warfare, but for spiritual development and helpful co-operation within nations and among nations in all the ways of peace, justice, and good will.

In vigorously promoting such a philosophy of religion and science through its lecture department, the Y. M. C. A. can continue to make in the new China a contribution of incalculable value.

The government has encouraged the establishment of museums, libraries, and public reading rooms for popular education. A report by T. C. Tai, 1923, lists 30 traveling libraries, 51 public libraries, 239 free public libraries, 23 college and university libraries, and 12 society and special libraries—also several active library schools. A large majority of these libraries are operated on modern lines, have some modern books, and supply many magazines and newspapers. Worthy of special note is the fact that the modern books are those which are in greatest demand. The best of the libraries are administered by college graduates with special training in library science.\(^1\) This is a hopeful and growing movement and its influence is rapidly extending into the government normal and middle schools where library development on modern lines has been very rare.

Besides the lecture and library movements, there are several promising movements for the education of illiterates.

The government program includes: (a) public "make-up" schools (Pu Hsi Hsueh Hsiao) for those over sixteen years of age who have had no schooling, and who attend eighteen hours a week; (b) half-day schools for those under sixteen who attend half-day sessions for three years; (c) language-made-easy schools for adults without

---

school training who attend usually twelve hours a week for
two years; (d) open-air schools with two two-hour sessions
a week. The numbers of these various classes of schools
reported are, respectively: (a) 79 in 1915, (b) 1,614 in
1918, (c) 4,599 in 1915, (d) a small and uncertain number.

In order to help in the education of illiterates, Mr.
T. E. Tong, of Shanghai Baptist College, attacked the
problem in a new way. He selected six hundred of
the characters in most common use; and employing these
only, wrote a series of textbooks on the
elementary subjects of most vital im-
portance to adult citizens. He also wrote
follow-up books, and edited a magazine on
current events, care of children, agriculture, etc. From
1913 to 1918 nearly four hundred schools using these
books had been opened by private teachers or organiza-
tions; and more than four thousand students—many of
them forty years of age or over—were studying in them.

More noteworthy than any of the agencies mentioned,
are the popular education movements of the Y. M. C. A.
and the Chinese National Association for the Advancement
of Education.

The Y. M. C. A. started with a series of three readers,
using a thousand characters selected according to fre-
quency of common use; and a committee of the Chinese
National Association for the Advancement of Education,
building on the experience of the former, made a series
of four readers using about twelve hundred characters,
more carefully and scientifically selected, and embodied
in a more carefully graded sequence of lessons.

In each series, about ten new characters appear and
are taught in each lesson. These readers are very inter-
esting, and their content is educationally constructive.
Both movements are having a large success and are
proving their feasibility.

The Y. M. C. A. system works in intensive campaigns
or "drives," in one city at a time. It introduces the
new lessons by lantern slides in large classes and gives
the practice and drill in small subclasses.
The Chinese National Association for the Advance-
ment of Education operates by organizing many small
reading circles, reaching those in homes and shops who
cannot go out to attend classes. Districts are mapped
out, organized, and subdivided under supervisors. The
system works by geometrical progression. One person
teaches from two to five others and these begin to
teach yet others with the first reader, even while they
themselves are studying the second. The readers and
the methods of teaching are worked out and standardized
psychologically according to the well-known laws of the
learning process. The expense is very small; for through
the cooperation of the Commercial Press, the readers
are published at a nominal price of only twenty cents a
set, and the teachers and supervisors of the circles are
all voluntary workers. Nearly a million of these readers
have already been sold; and orders are coming in from
many parts of the country which have not been visited
by the promoters, and where information concerning the
movement and methods has come only through the
newspapers and periodicals.

III. MOLDERS OF PUBLIC OPINION

All the organizations and movements that have been
sketched in this and the preceding chapter,—the guilds,
the chambers of commerce, the renaissance movement,
the student movement, the schools, libraries and mu-
seums, and the popular education movements—consti-
tute powerful agencies for the formation, education, and
direction of public opinion.

One of the best services that can be rendered to China
is to help the people to understand the power which
can be exercised through these agencies for clarifying
and focusing public opinion, and to teach them how to
use it only for wise and constructive ends. The wis-
dom which must guide this force of public opinion in the
future must be imparted to the students in the schools of
to-day; and this should be the great patriotic enterprise of
the present-day teachers.
CHAPTER 6

THE ECONOMIC FOUNDATIONS

I. Relation of Schools to the Economic System

The essential factors of the educational process are the learners or pupils, the curriculum, or selections of the racial heritage of culture to be assimilated and passed on by the rising generation, and the teachers, who organize these materials for instruction, and supervise or assist the pupils in the learning process.

In a primitive society these essential factors are present in (1) the children, (2) the simple activities of the tribe, which the children (3) learn in their play by imitating their elders, or are taught by the parents individually.

In a complex and highly organized society, specialization of occupations and activities brings about a more complex and varied body of knowledges and skills to be imparted; and professional teachers are necessary. Since these teachers give their full time to educational work, they produce nothing for their own support. They must be supported in compensation for their service by a part taken out of the surplus that is produced by those who engage in the more material occupations of production, transportation, and commerce. Where pupils and teachers gather for instruction in the complex curriculum of a civilized society, there must be buildings and grounds where the various activities may go on uninterrupted in a favorable environment. Also there must be furniture and apparatus, most of which ordinarily is materially nonproductive, and which also, therefore, must be provided and maintained out of the surplus production of material goods.
Only the strictly vocational types of education can by any means be made to pay their way directly in material goods, and then usually only partly. In fact, from the production standpoint, they usually operate at a large loss, their net cost per student being higher than that of any other type of education, excepting only that of the medical schools.

The contribution of the schools to production, though not directly and immediately visible is, however, the most important of all; because it is the means of preserving, increasing, and imparting the general and technical knowledge without which modern scientific methods of production and distribution cannot be maintained and progressively improved. It is to the schools, also, that we look for imparting the habits, ideals, and standards of social conduct that make democracy possible, and for arousing the appreciation of aesthetic and spiritual values without which no amount of material goods can make life much worth living.

Since the schools, then, are fundamental agencies in the production of all material and social values, it is necessary that they be adequately maintained. If they are not efficient and are not giving the quantity and quality of training that the community needs, they must be better supported and improved. To neglect them is the worst kind of economic and social folly.

Schools and their teachers and officers, then, are and must be supported out of the surplus of material production.

In the case of private schools, this support comes in the form of tuition fees which the school collects from the families of the pupils.

In the case of the public schools, that part of the surplus of production which is needed for all its common purposes is collected for the community from the families in the form of taxes; and that part of it which is necessary for the maintenance of the schools is paid over to them and disbursed by them in payment of the salaries.
of teachers and officers and in payment of other expenses.

The functions of assessing and collecting taxes and of appropriating and paying the funds to the schools as well as to all other tax-supported community enterprises is performed by the government. Theoretically, the government is merely the servant or agent of the people when they wish to act collectively, and is itself supported by taxation, which in theory is voluntary.

This analysis should make it perfectly clear that everything that the schools do in a complex organized society requires material support, which in the case of public schools must come in the form of financial payment from the public treasury. Also, when maximum economy and efficiency are both maintained, the quantity and quality of work done by the schools must be proportional to the amount of funds available to operate them.

Hence it is clear that ultimately every question as to reforms or improvements in public instruction goes back to the tax sheet; and the foundation of the educational structure is laid in the economic resources and the economic system.

If the resources of the country and its economic system cannot produce an adequate surplus, then the schools must be inadequate and inefficient. The schools are always the first to lose when the surplus shrinks and the last to gain when it swells; because they must for their very life keep out of politics; and politicians always take care of themselves and every other interest before they do anything for the schools. They are sure to starve the schools unless a united public opinion forces them to do otherwise.

II. EDUCATION AND ECONOMIC RECONSTRUCTION

We have seen that China has made an astounding record in the rapid establishment of public schools and subsidized private schools since 1900, and that universal
publicly supported education is the goal towards which she is aiming. Yet rapid and creditable though its growth has been, only a brief study of the school system is needed to reveal the fact that it is not only vastly inadequate for the country’s needs, but also is in many respects very inefficient. One source of this inefficiency is its rapid growth. Time and the efforts of the schoolmen and women will gradually remove the defects arising from this source.

The ultimate cause of all the other deficiencies—a cause which time alone cannot remove—is lack of adequate financial support. As we have seen, this takes us back to the tax sheet and thence to the question of the surplus of production, which is the only source whence taxes can be drawn.

Since there are so many of her people at the minimum level of subsistence or below, it is clear that China has no large surplus. With the utilization of all the means of taxation that her officials can devise, there is still not enough to carry on the proper functions of the government. True, much of what is collected finds its way into the coffers of corrupt officials; but even if this iniquity did not exist, there would not be sufficient surplus to finance the things that are urgently needed.

Now a surplus can be created by an individual or a nation in just two ways: (a) by economizing and thus consuming less, and (b) by producing more.

China is producing probably all she can produce under her present economic system; and, excluding a relatively small part of her population, she is economizing to a greater extent and with greater success than any other civilized people. Even the wealth wasted by the officials and the rich, were it taken from them and distributed to the poor, would not provide for more than their bare needs. It is clear, therefore, that China cannot create a great surplus by further economies; so she must do it in the only other way—that is, by increasing production. Moreover, since an immense surplus is needed to provide for education, sanitation, and other necessary public
improvements, a small increase of production will avail little. Such a vast increase as is required can be brought about by nothing short of complete industrial reconstruction.

The task is so immense that it cannot be accomplished immediately; but evidence is not wanting that the change has already begun, and is going forward with surprising swiftness. Indeed, there is some danger that it may come so rapidly as to outstrip the facilities for training the men to direct it wisely. A fine and unique opportunity lies before the Chinese people to bring about a real industrial reconstruction instead of going through a long period of strife between capital and labor such as has characterized the industrial revolution in Europe and America. Indeed, it will be pitiful and shameful if China shall not learn from the mistakes of the Western countries, and reconstruct her industries on a basis of fair play and cooperation instead of leaving all to the blind forces of competition. The opportunity is here for building a new social order, if only the rising generation of industrial managers shall be trained to understand. If the capitalists and managers of the new industries that are coming on shall be willing to accept reasonable profits for themselves and give to labor a just share, then friendly cooperation and not warfare will be the basis of their relations, both parties will work for increasing efficiency through scientific management, both will prosper; and strikes, lockouts, riots, and boycotts, which too generally have embittered industrial relations in the West, will be unknown in China. The temptation to exploit labor is very great when the opportunity and the power are present; but let us hope that the captains of industry in China will place service to their fellow men above great riches, and refuse to yield themselves to selfishness and greed. There is opportunity here for a patriotic service greater than that of leading armies and navies—a chance to
initiate a new period of industrial history in which China shall stand as one of the leaders in a new world order. Will the young men of China rise to this opportunity? Let us hope and pray and believe that they will!

In this development, science must take a leading part, but economics and finance, economic and social history, politico-economic geography, political science, sociology and enlightened ethics, are just as necessary, otherwise the discoveries and inventions of science will be used by the unscrupulous as a means of exploiting the laborers and the public for the enrichment of themselves alone.

This will be the inevitable outcome in China, as it has been elsewhere, unless the forces of education shall prevent it. It can be forestalled only by planting ideals of unselfish service in the minds and hearts of the present generation of students, and by training them in the knowledges that will make them competent to operate the technical machinery, control the economic forces, and direct the social interactions according to the principles of righteousness, justice, and good will. Hence training in the social studies, and actual practice in social coöperation for the common good are no less essential to the education of young China than science and technology.

The factors of the economic system are:

1. The raw materials from the forests, the mines, and the farms.
2. The means of transportation—roads and vehicles, railroads and their equipments, waterways and boats for traversing them, and aeronautic devices such as airplanes and dirigibles.
3. Skilled human labor by means of which raw materials are converted into manufactured products with aid of machinery and scientific management, which make possible an immense multiplication of production.
4. Commerce by means of which exchange of products is carried on.
5. Finance and banking through whose agency the capital needed for carrying on large industrial and commercial operations is obtained—by receiving the savings or surplus of individuals who are not using them, and combining them into funds to be used as capital stock or as loans by other individuals or corporations who do need to use them.

The scientific problems to be solved in connection with these factors are numerous, varied, and difficult; but all of them have been solved in various countries at various times and in various ways; and the Chinese can solve them—by taking the experience and knowledge which is available from these other countries and applying it to the conditions that exist in China.

For this work, China needs trained scientific foresters to reclote her denuded hills and mountains with such noble trees as may be seen around her ancient temples, and to protect and regulate the new forests so that they will provide a steady supply of lumber, fuel, and other forest products. She needs scientifically trained geologists and prospectors to explore and map her mineral resources and estimate their kind and extent, and trained mining engineers, foremen, and managers to expand and perfect her existing mining enterprises and develop new ones in the unexploited fields. She needs more agricultural experts to solve the problems of crop improvement, of stamping out plant and animal diseases, and of educating and helping the farmers to get increased production through scientific methods reduced to routines which they can understand and use. She needs civil engineers to build railways, roads, and bridges, to improve waterways, and to carry out conservation projects for the prevention of floods and the irrigation of arid lands. She needs mechanical and electrical engineers to build locomotives, cars, steamboats, automobiles, airplanes, telegraph and telephone lines, and wireless stations,
and to invent, build, install, and operate machinery for all kinds of factories. She needs industrial managers and foremen to manage intelligently, efficiently, honestly, and fairly all the big enterprises of manufacturing and transportation. She needs trained merchants and commercial experts to carry on the exchange and distribution of the products of the forests, the mines, the farms, and the factories. 

Finally, she needs honest and expert financiers, bankers, and accountants to conduct the financing and accounting of all these great projects that are to come with the economic reconstruction. The schools and colleges must address themselves to the training of such men, ready and equipped for the new order. They must impress their students with the magnitude and importance of the tasks and opportunities which lie before them, and incite them to their best efforts to prepare themselves for the great responsibilities which they must shoulder in the days to come.

If these great problems shall be rightly solved, the solutions will result in a vast increase in the production of wealth and a redistribution of the population, which for several generations at least will greatly ease the pressure of population on the means of subsistence. The solutions will make possible the accumulation of capital which is necessary for the development of the industries and for financing education and those internal improvements that benefit the health of the people, afford them better living conditions, and foster aesthetic and spiritual growth.

These changes cannot be expected to come all at once; and, in fact, were they so to come the result would be disastrous. Many occupations of production, transportation, and exchange that now exist, even though as efficient as they can be without modern methods and machinery, will become obsolete because unable to maintain themselves in competition with the more efficient cooperative industries. The small craftsmen and traders would be thrown out of employment faster than they
could prepare and adjust themselves to the new occupations.

It is fortunate, therefore, that the transition must and will be gradual; and it must be foreseen, planned for, and guided, so that it may be a process of reconstruction in which readjustments shall be provided for and carefully directed in connection with each new industrial unit as it is set up, organized, and put into operation.

III. The Fine Arts and Art Handicrafts Must Be Preserved and Promoted

Finally, there is one other factor in the economic and social situation which ought to be considered with great care and solicitude, and provided for by wise planning and energetic direction.

The artistry and artistic handicrafts which constitute one of the most precious contributions of the old civilization of China to human culture must not perish and be lost to China and the world.

They will surely die if something is not done to save them,—through agitation, through public education in appreciation and in the processes of art-craft production, and through the fostering and development of markets for art-craft products both at home and abroad. There are no more emperors and princes like K‘ang-hsi, Ch‘ien-lung, and Kuang-hsü to take the initiative in encouraging and supporting these wonderful arts and crafts whose products have gained for the old China the admiration and gratitude of the artistic world. Let young China see to it that in the Republic with the introduction of machine-made goods the taste for those objects of beauty alone, or of combined beauty and utility, which can come only from the hand and brain of the true artist and the truly artistic handicraftsman shall not die. Let her provide that the production of paintings and sculpture, of beautiful objects carved in wood and ivory and jade, of decorated bronzes, pottery, and porcelains, and of art
textiles and embroideries, shall continue, that the standards of artistic merit shall not be degraded, but shall again be lifted to the altitude whence they have declined, and that not only shall the old designs and conceptions be executed on higher planes of merit, but that new designs and conceptions of equally high merit shall also be evolved and materialized. This can be done if wise statesmanship and the public spirit of well-to-do citizens determine that it shall be done, and take the measures necessary to accomplish it. In China even now the public taste in art and architecture is being degraded and destroyed by cheap and gaudy imitations of foreign art productions and foreign architecture. The current of decline must be checked, or it will soon sweep away the artists, the art treasures of the old China will be found only in foreign museums, and there will be no new creations to take their places.

If some wealthy Chinese citizens wish to win immortal fame and lasting national gratitude, let them endow and establish a national institute of art research and design, and intrust its conduct to a board of trustees composed of the most eminent and trusted art experts in China—both Chinese and foreign. Let these trustees choose a staff of artists, designers, and specialists in the history and teaching of art, whose business it shall be to conduct the institute for art research and for the training of artists and teachers of art, and also to plan and promote a system for teaching art appreciation, design, and artistry in the schools. Let it be their business also to plan and promote a country-wide system of art associations with whose coöperation exhibitions and art fairs may be held in all the provinces, and illustrated lectures may be given by experts and trained lecturers on the periods and productions of arts, crafts, and architecture—both those of China and those of foreign countries.

Finally, let the faculty and trustees of this art institute work out plans for organized action by citizens, guilds,
chambers of commerce, and government officials, for the purpose of preserving and promoting the arts and crafts, and maintaining standards of architecture; and let them push these plans vigorously to the end that persons with talents and genius in these artistic fields may be sought out and encouraged, that they may secure the requisite education, and that when they have become masters, they may be assured of rewards sufficient to stimulate and foster their best efforts. Remembering also that the productions of real artistic masters are expensive, and can be purchased only by the wealthy, the processes of art reproduction (engraving, etching, photography, photo-engraving, lithographing, etc.) should be encouraged; but rigorous standards of quality should be maintained, and reproductions of poor quality should be vigorously disapproved. The same policy should be pursued relative to imitations of the works of the old masters in painting, bronzes, carvings, etc. Only worthy imitations should be encouraged, and every imitation of a masterpiece should be marked as such, by means of a brand or stamp that can be plainly and unmistakably recognized. By means of such vigorous measures, art and artistic taste in China may be preserved and will contribute mightily to the aesthetic and spiritual development of the people in the new era.
CHAPTER 7

POLITICAL FACTORS AFFECTING EDUCATION

I. THE SCHOOLS ARE INVOLVED IN THE
   POLITICAL SYSTEM

IN the preceding chapters it has been shown that the
schools in China are closely related to social and
economic conditions that have evolved through her
long history. They are also related to politics,—so
closely in fact that this connection is very unfavorable
to their normal and efficient development, as in various
ways will be shown hereafter.

No school system supported in whole or in part by
funds derived from taxation can be wholly
free from political pressure until that
happy time when problems of taxation
shall become known as scientific prob-
lems, and shall be solved by scientific methods apart
from party politics; yet the principle that the schools
should be kept out of politics is recognized by all sincere
and thoughtful educationists. Any power that politicians
may have to control the internal affairs of schools or
limit their financial resources is certain to be used at
some time and by some individual to accomplish political
or personal ends. When this happens the schools al-
ways suffer harm.

Hence any system of school control that is closely
interlocked with political interests is open to criticism
and needs correction. Let us examine briefly the manner
in which the control and financing of the schools is linked
up with the political structure.

The head of the entire national system of education
is the Minister of Education, who, with the other Cabinet
ministers is appointed by the president, subject to the confirmation of the National Legislature or Parliament. Associated with the minister in the Ministry of Education are a vice minister and three councilors, together with a staff of officials and clerks, which is organized into four divisions—General Supervision, Special Higher Education, General Education, and Social Education. Through one or another of these divisions, control is exercised over all the schools and higher educational institutions that are supported or subsidized from public funds, and over all public agencies of an educational character, excepting that there are a certain few technical schools and colleges that are controlled and supported by the Ministry of Communications or other departments of the central government.

Control of educational affairs in each of the twenty-four provinces is exercised through the Provincial Department of Education which consists of the Commissioner of Education and a staff of deputies, inspectors, and clerks. The commissioner is appointed by the president on the nomination of the Ministry of Education and with the consent of the Cabinet; and he acts under the joint direction of the Ministry of Education and the civil governor of his province.

The commissioner exercises his authority in each hsien or county, through the magistrate, the chief county official, in whose office there is a department or Board of Education.

The magistrate, through the Board of Education, controls the village and rural schools of the various districts into which the county is divided. His representative in each district is a “delegate of school affairs,” who is usually poorly paid and deficient in educational training. The active educational officer in the county is the supervisor, who is the deputy of the magistrate for educational affairs.

The time and attention of the Commissioner of Education and his staff is occupied mostly by the problems
of the schools of middle grade, which are in the cities; so the elementary schools in the cities get very little supervision or direction, and those in the villages and rural districts get practically none.

Each college, university, or school above primary grade, and every primary school excepting the small rural schools, is controlled by its president or principal, who receives and disburses all the school's funds, and is responsible for the administration of all its affairs, including the appointment or dismissal of teachers and other employers.

Presidents of national schools are appointed directly by the Ministry of Education and are directly responsible to it. Presidents and principals of provincial colleges and schools are appointed by the governor of the province, and are directly responsible to him or to him and the Commissioner of Education jointly. Principals of county or district schools are responsible to the Commissioner of Education and the governor, or to them through the magistrate.

Excepting that it follows the curriculum and general regulations laid down by the Ministry of Education, each school or higher educational institution is subject to very little constructive supervision of its educational activities. The activities of the inspectors from the Ministry of Education or from the Provincial Departments of Education usually are limited to inspections and brief reports, which are for the most part perfunctory. The result is that so far as internal management and educational activities are concerned, the schools are mutually independent and autonomous. Each school is a law to itself, and gets little help or educational advice from the outside.

The national universities and colleges, including the higher normal schools or teachers' colleges, receive the funds for their support directly from the national treasury through the Ministry of Education. The provincial colleges and schools receive their funds from the provincial
treasury through the office of the governor or the Commissioner of Education. A relatively small number of public schools receive their funds mainly from municipalities or districts. Most of these and most of the private schools and colleges receive subsidies from the provincial funds, and must therefore come under the control of the provincial government officials with reference to certain uniform government regulations as to curriculum and administration applying to schools of the class to which each belongs.

From this outline of the organization of school control and administration four facts of fundamental importance emerge:

1. External control of the schools is wholly political, and completely centralized through lines of authority extending up through the Commissioner of Education and the provincial governors to the president who appoints the governors, appoints the Minister of Education with the consent of the Cabinet, and also appoints the Cabinet subject only to confirmation by Parliament.

2. The internal administration of every school is decentralized under the principal, whose authority under the general regulations is supreme within the school. Inspectors and deputies of the Commissioner of Education, or of the Ministry of Education, have no direct authority over him; and if he has sufficient political influence with the higher officials he can disregard the inspectors, and manage all things to suit himself. He can do this up to the limit to which he is supported by the highest official to whom his political influence reaches—but no further; and he can do it in carrying out a purpose which may be either good or bad for the institution over which he presides.

3. If the president or principal of a school is strong enough politically, and can hold his political influence, he can be an autocrat; but if opposition to him from within the faculty or student body either rightly or wrongly can exert a stronger political influence either through assistance by public opinion or through the
assistance of the parents and friends of some of the
students who may have high political connections, the
principal may be checked or even driven out.

4. Conversely, any firmly intrenched official can,
if he chooses, reach down through political channels, and
dictate the appointment or dismissal of a teacher or
principal; or he may interfere with the disciplining of
any student or students, or cause the abandonment
of any policy which is obnoxious to him or to any body
of his friends.

This outline of the political structure and its relation
to the schools reveals a situation in which the officials
and revenues of the schools are closely linked up with
the activities of politicians. Bad for the schools as this
situation is, only half the story has yet been told; for
the anomalous position of the military chieftains and
their relations to the civil government has not yet been
mentioned. The military governors, or tuchuns, one
for each province, are appointed by the president, who
"appoints and removes all civil and military officials
on his own responsibility, except in the case of the
appointment of members of the Cabinet, ambassadors, and
ministers, when the concurrence of the legislature is
necessary." So the president appoints both the civil and
the military governors.

"The military governor (tuchun) is the highest ranking
official in each province. Except in times of disturbance
when military law is proclaimed, his authority extends
only over military matters, which he directs subject
to the orders of the president, the Ministry of War, and
the General Staff at Peking.

"The governor, or civil governor (sheng chang) is the
chief civil authority in each province. All governmental
activities in the province except those of a military
nature come within the scope of his authority. In matters
relating to foreign affairs, finance, education, industries,
and justice, he acts in close touch with the central govern-
ment at Peking, and in consultation with its provincial
representatives.
“The governor exercises a direct control over the lesser territorial officials in the provinces, the taoyins and district magistrates, the latter being appointed or dismissed subject to his recommendations. The governor may issue provincial orders, and may suspend the orders issued by the taoyins and district magistrates. He controls the provincial militia, and in case of necessity may request the cooperation of the regular military establishment.”

The taoyins are a sort of subgovernors, who direct the political affairs of the several tao—from two to ten—into which the province is divided. Each tao contains a number of hsien, or counties. “The taoxin acts under the supervision of the governor of the province, and within his jurisdiction his powers are similar to those of the governor. He exercises general supervision over all the acts of the district magistrates within his jurisdiction.”

It would thus appear that theoretically the military governor has nothing to do with the civil administration; but practically the case is far different, since the tuchuns and “super-tuchuns (military chiefs of two or more provinces) are commanders of large forces of soldiers, and are more powerful than the central government, which they group themselves into various military cliques or “parties” to control. They are like the feudal barons of medieval Europe in that any one of them, if he has sufficient military strength, can disregard the mandates of the central government within his province or may combine with others to intimidate it, to force out a cabinet and compel the formation of a new one acceptable to them, or even to drive out the president, and set up one of their number in his place. They are unlike the medieval European barons, however, in that they do not have any notable or active following among the people, who never fight for them or against them, and who rarely find among the tuchuns a champion to redress their wrongs or to engage actively in the promotion of

---

their welfare. The tuchun's power rests not at all upon the support of the people of his province, but on his legions of hired soldiers whose only interest is in their pay. Consequently, the chief concern of the tuchun is not in suppressing banditry and maintaining order and safety in the province; but due to the very nature of the politico-military system, his principal activities must center around getting control of every possible source of revenue in order to pay his troops and hold them together. While the tuchuns, like the civil officials, are appointed by the president, and are supposed not to concern themselves with civil affairs, the real fact is, then, that in each province, the tuchun is the controlling power; and any official, from the civil governor down, must find out whether any action he contemplates will be acceptable to the "war lord" before he takes it. Otherwise he may get himself into a position where his plans may be thwarted, or his resignation may be forced, or even worse things may happen to him.

Thus a school official, to hold his position, must take care that he gives no trouble or annoyance to any political official, and that all his acts shall be acceptable or at least unobjectionable to the tuchun. Hence it comes about that throughout the political organization, to which the schools are bound hand and foot, the political interests of the military governor and the financial support of his legions and his staff must receive the first consideration. As it works out practically, therefore the state of the schools in any province is very largely dependent on the interest that the military governor may have in education, and how enlightened his views on the subject may be.

Fortunately for a few provinces, their military governors have at times taken a very considerable interest in educational affairs, and in the social and economic development of their provinces; and it goes without saying that in such provinces education in general is in better condition than elsewhere. Nevertheless, as should now be evident, the system of school control and finance is very
faulty. It leads directly to grave abuses and inefficiency throughout the school system, even where it is seen at its best. Therefore serious steps should be taken to divorce the schools from political control as completely as is possible. The description of the relationships between the political system and the schools, which has been presented in this chapter, will, it is hoped, place the reader in a position to apprehend the first two and most fundamental of the findings of this survey. Therefore these may be stated now in dogmatic fashion without further comment or argument excepting to say that they are based on evidence gained by personal observation and interviews in the cities and schools visited.

II. RESULTS OF POLITICAL CONTROL

1. The greatest and most fundamental handicap of the science teaching, as well as of all the teaching and the general administration and discipline of the schools, results from the interference by high political and military officials and influential gentry who are using the school systems in countless and devious ways as agencies for the promotion of their own private ends and advantage. This practice is revealed in many outcroppings such as the following:

Intimidation of principals and college presidents, resulting in favoritism in the appointments of teachers, overstaffing with minor administrative officials of doubtful competency, silence and inactivity with regard to such conditions as inefficiency of teaching, poverty and neglected condition of equipment, lack of cleanliness and efficient upkeep of the school plant, and finally failure to enforce good standards of industry, scholarship, and general behavior on students impartially because of the pressure brought to bear in favor of the children of influential persons or of persons who have influential friends.

Such intimidation is possible because the tenure of principals and presidents is practically at the pleasure
of the political or military clique, local or central, which happens to be in control. Fortunately there are some outstanding administrators who have been strong enough to resist political pressure, but there is not known a case of one who has not been vexed and embarrassed by it; and resignations from this cause have not been rare.

2. It is a matter of common talk and newspaper comment in China that funds raised by taxation and earnings of the government railways are diverted to the maintenance of factional military forces and other purposes not designed primarily for the benefit of the public. This results in starving the schools and discouraging the schoolmen. There are a few brilliant exceptions in which this condition is not so bad; but at present there is no certainty as to how long the ultimate control will remain in the hands of capable and progressively intelligent officials or for how long adequate funds will be available for the schools.

Practically all thinking persons agree that important reforms must be made in the system of government looking towards greater stability, greater responsiveness to public opinion, and the abolition of the tuchun system and militaristic rivalries; but as yet no such changes are in sight, and sweeping reforms in the control and financing of the schools cannot be made immediately, even though they are so much to be desired.

In the meantime, the only thing that can be done by the school people and the friends of education is to make as firm and united a stand as is possible for the best ideals in education, apply these ideals within their own jurisdictions to the fullest extent within their power and authority, and work in tactful and uncontentious ways for the education and organization of public opinion. For this work of improving the administration and teaching within the schools, and educating, consolidating, and directing public opinion for the support of progressive school policies, the existing faculty meetings, teachers' clubs, the local, provincial, and national educational
associations, and the educational press provide organizations already at hand and capable of being utilized. In this field of effort there is opportunity and scope for every enthusiast for educational reform; and it is certain that unless many individuals are thus willing to work and to join their efforts for cooperative discussion and action little can be done for the improvement of the schools. On the other hand, united efforts by various individuals who may associate themselves for study and constructive work on reform problems within their special fields of educational interest can accomplish a great deal for improvement within the schools in spite of all the difficulties arising out of the system of political control.
CHAPTER 8

CAN THE SCHOOLS BE EXTRICATED FROM
POVERTY AND POLITICS?

I. THE CONDITIONS SUMMARIZED

In Chapter 6, we saw that the educational system, for any large improvement in its unfortunate financial status, must await the coming of an era of greater economic production, a better transportation system, and a wider-spread and more efficient commercial and financial organization. Until these are evolved, progress in the schools must inevitably be slow; but the school people themselves, through harder work, more intensive preparation, and an intelligent understanding of the social and economic factors at work in the Republic can do much to hasten the advent of the new era.

The school people can do this by training their students up to a higher plane of social, economic, and scientific thinking, so that they may take their parts in carrying forward the process of social evolution and economic reconstruction and in directing its cross-currents into the right channels.

When, because of improved social and economic conditions, the taxpaying power of the people shall have become greater, then the schools, as well as other social interests, may get their share of the surplus of production; and the result should be more and better education for all the people.

We have seen that the process of economic and social change has already begun; and we may expect that if wise guidance and enlightened counsels prevail, reconstruction will go on steadily, and will produce a steadily increasing surplus. So in this direction there is both
hope for the schools and opportunity for them to help themselves by helping in the process of reconstruction. With every stage of advance accomplished, their power to help in making further and more rapid advances will be increased.

In Chapter 7, however, it became clear that unfortunately the school system is involved politically in such an intimate way that its efficiency is directly impaired, and also it is not getting its share of the funds raised by taxation. Moreover, there is danger that when more funds become available, the politicians who may then be in power will divert these funds to other channels and continue to leave the schools in straitened financial circumstances. The question that arises here—a question to which every one interested in the schools must be anxious to find an answer—is, Is there any way out of these political entanglements; and if so where does the way lie?

Naturally and rightly, it is expected that when an investigator discovers imperfections in the system under survey he should advance something constructive in the way of remedies for the conditions that are criticized; and this an earnest and sincere investigator always tries to do. In this case, however, the task is an exceedingly delicate and difficult one. In the first place, it is obviously delicate because the bad conditions that inevitably result from bureaucratic control of the schools cannot be wholly eradicated as long as the present governmental structure remains just as it is; and although it appears to be quite proper for a foreigner to point out clearly what he conceives to be the relation of cause and effect in the educational situation, it is not fitting for him to suggest essential changes in the structure of the government.

In the second place, as regards the organization of the educational system, there are some quite important changes that should be recommended on well tried educational principles, and which in all probability would represent the best ultimate remedies for present defects;
but such changes if made immediately or suddenly would only serve in many cases to make matters even much worse than they now are. It is this consideration that makes the task of constructive recommendations at this point so very difficult.

In these circumstances, the most useful service that can be rendered would seem to be that of indicating the principles of educational organization that appear to be justified by experience under a republican form of government, and stating them in such a manner that the friends of education in China may set them up as guideboards along a path of reform whose ultimate goals can be reached only after much travel and considerable time.

With the purpose and limitations just stated clearly in mind the following outline is presented of what would seem to represent an ideal system of educational control. It may be serviceable if set up tentatively as the goal ultimately to be attained and to be approached whenever and wherever advances can legitimately be made without changes that would give a permanent setback to educational units that are now functioning effectively and progressively.

II. THE WAY OUT. AN IDEAL EDUCATIONAL SYSTEM

A. Ministry of Education with divisions as follows:

1. One great National University, comprising colleges of Arts, Sciences, and Philosophy, Law, Medicine, Education, Commerce and Journalism, Engineering, Agriculture and Forestry, Veterinary Medicine and Pharmacy.

   a. Financed by the government through the Ministry of Education, which reviews and
finally determines the budget presented by the Board of Control.

b. Under a Board of Control appointed by the Ministry of Education, and consisting of seven members, each appointed for seven years. The term of service of only one member to expire each year, members to be citizens of the highest intelligence and character not holding other official positions under the government or actively engaged in politics, being active or retired professional or business men representing various types of professional, business, and social experience, having, therefore, good judgment on general affairs, and common sense in matters related to their administration, but not necessarily having any highly specialized knowledge of the science and art of education. The members of the Board of Control should serve without salaries from patriotic motives, and should receive only their legitimate and necessary traveling expenses when attending meetings of the board. The Board of Control to have final authority in the matter of the appointment and dismissal of the president, confirmation of the president’s appointments of faculty and employees, and final decision on educational and administrative university policies proposed by the president, or the faculty through the president. The Board of Control to have control and decision on all proposed changes in internal administration and curriculum affecting increases in the budget, but not over other educational details, which should be reserved to the faculty.

c. Each college of the university to be presided over by a Dean, to be nominated by the president and elected by the faculty
of the college. Faculty and employees to be appointed by the president on recommendation by the deans of colleges and heads of department concerned. University Faculty to be the body of final review on educational matters excepting those involving increases in the budget. All colleges to be so coordinated as to avoid duplication and promote the efficiency of the university as a teaching and research institution covering the fields of scientific, technical, economic, social, and intellectual activity, and especially those problems of thought, research, and technology that are closely related to national development and progress.

d. The National University to be available for advice to the government, whenever called on by the various ministries or bureaus, concerning problems of academic or scientific nature which the government needs to have solved by the scientific method of experiment and research.

2. Power and authority of the Ministry of Education over educational officials and activities in the provinces to be limited to inspection and regulation of only those special educational enterprises which are financed by the central government, or under national laws by the central government and each provincial government jointly. Such, for example, are vocational education, elimination of illiteracy, highway engineering, etc., which may be especially essential to national progress, particularly in connection with national emergencies that the provinces should be stimulated to cooperate in meeting. Such, also, are national educational enterprises to promote the advancement of provinces or sections that are
suffering from special educational or economic disadvantages and therefore need national aid. The principle to be kept in mind is that education develops best and is most democratic and efficient when conducted and financed by local units on their own initiative, and the central government should step in only when stimulation and aid are necessary in the national interest.

3. The main government educational function aside from the enterprises mentioned should be the promotion and stimulation of educational endeavor through spreading information regarding the most approved theories and practices within the nation and abroad. Political and bureaucratic control of education in the provinces should be avoided in the public interest.

4. An educational system for the Metropolitan District of the national capital under the administration of a metropolitan district board of education, responsible to the Ministry of Education and appointed by it after the same manner as that described for the Board of Control of the National University. The organization of the executive staff under this board should be similar to that of the provinces.

B. For each province, a Provincial Board of Education, appointed by the civil governor, similar in composition and character to the Board of Control of the National University and the Board of Education of the Metropolitan District. This board to be the ultimate authority in the direction and control of general educational affairs in the province. It should be wholly free from dictation or interference by the governor or his agents excepting in the matter of revision and approval of its annual budget, authority for which should rest with the financial department.
of the province with the advice and supervision of the civil governor.

1. It should operate under the laws applying to matters of education in the province, and should be responsible for their proper observance.

   a. The executive and administrative head of the provincial school system should be the Commissioner of Education. He should be elected by the Board of Education for a term of five years, removable only by trial and impeachment, and eligible for re-election if he prove himself worthy.

   Provincial Department of Education. He should be a professional educator of high character and attainments and large educational experience.

   b. Under the Commissioner of Education there should be an adequate staff, organized in six divisions with the same names as those enumerated for the Ministry of Education, and having similar functions. The chiefs of these departments should be elected by the Board of Education on the recommendation of the Commissioner. They should be experts in the fields of education to which they are assigned; their appointment should be indeterminate, and they should be removable, excepting by voluntary resignation, only by the Board of Education after a formal hearing at which they may employ legal counsel.

   c. The functions of the Commissioner of Education and his staff and their relations to the smaller educational units within the province should be similar to those of the Ministry of Education with relation to the provinces, excepting that the authority to choose and appoint the members of the Board of Control of the Provincial University and
also the members of the Board of Control for the provincial normal schools, should rest with the civil governor.

2. In each province there should be a Provincial University similar in scope to the National University, though perhaps for some time to come so many colleges and departments will not be either necessary or desirable for any one provincial university, as are necessary for the National University.

   a. The Provincial University should be under the authority of a board of control appointed by the civil governor of the province. The composition, organization, and functions of such board of control should be similar to those of the Board of Control of the National University.

   b. The internal government and organization of the Provincial University should be similar to that outlined for the National University.

   c. Each Provincial University should have a Teachers College for the training of high school and college teachers, supervisors, and educational administrators.

3. In each province there should be one or more Provincial Normal Colleges offering a two or a four years' curriculum (or both) above the senior middle or high school, for the training of primary, kindergarten, and special teachers and supervisors.

   a. There should be one Provincial Board of Control for Normal Colleges appointed by the civil governor and similar in composition and organization to the Board of Control of the Provincial University. It should have control of all the provincial
normal colleges, elect their presidents, and confirm or disapprove the acts of the presidents or faculties, and otherwise function as a board of reference and control for each of these several colleges in a manner similar to that already outlined in connection with the Board of Control of the National University.

b. Each Provincial Normal College should have a president and one Faculty— the president to be elected by the Board of Control, the faculty members to be appointed by the president and confirmed by the Board of Control.

c. Internal affairs and educational procedure to be determined and conducted by the faculty under the general direction of the president. Larger policies and approval of budget subject to decision of Board of Control.

4. For each county there should be a County Board of Education, to have supervisory authority over all schools of the county excepting those in the city school districts, each of which should have a City Board of Education for itself. The County Board of Education should consist of five or seven resident citizens of the district elected by the electors of the county districts or by the presidents of the district boards of education (excepting those of the city districts), or appointed by the magistrate of the county.

a. Appointment by the magistrate is theoretically not so good as one or the other of the two methods of election, election being more democratic. But in the present organization of the governmental structure, election may not be feasible or wise, whether
because of the lack of suitable election machinery, or lack of a sufficiently trained and experienced electorate. In the latter case and until the popular electoral machinery is improved, appointment by the magistrate may be the best method of choosing the board. The principle here advanced is to keep the schools as nearly as possible under the control of the people's representatives rather than under the control of officials who are not elected by the people and are therefore not so likely to be sensitively responsive to public opinion. If the magistrates and also the taoyins and the civil governors were chosen by the electors of the political units over which they have jurisdiction, instead of all being appointed from without the province, they would all be more closely interested in provincial affairs and would be more responsive to the opinion of the electors. If this were the case, appointment of the county board of education by the magistrate and appointment of the provincial board of education by the governor would be more nearly democratic and less bureaucratic than it can be as the organization of the provinces now exists.

b. The executive and administrative head of the educational forces of the county district is the County Superintendent of Education. He should be a trained educator with experience, should be elected by the County Board of Education for a period of five years, and should be eligible for reelection.

c. The county superintendent should have under him a Deputy or an Assistant Superintendent, and as many additional Supervisors
as may be necessary ade-
quately to supervise and pro-
mote the professional growth
of the teachers and the various educational
activities of the schools. He should have also
a sufficient clerical force to carry on all routine
business and correspondence that is essential
to his work and that of the supervisors.

d. The county superintendent should select
and appoint all members of his department
staff and all principals, teachers, and officers
of the several schools of his district, having
due regard to the nominations or advice of
the principals. His appointments should be
subject to confirmation by the County School
Board.

e. Each county school district should have
at least one County Normal School, giving
training of at least one or two years of
professional work above the middle school,
at least one country middle
school, and a number of pri-
mary schools. If any of such
schools are not coeducational, similar schools
should be established for girls.

f. Within each school the relationships
of the principal and the teaching staff should
be similar to that described for the president
and faculty of a university or normal college
excepting that it may be simpler and less
formal because the school faculties will be
less numerous and diversified.

g. The main bulk of the funds for the
support of the schools of the district should
come from the taxes of the district under
certain legal limitations and safeguards.
The Board of Education of each district
should have the power and authority to
assess the local school taxes independently
of the political organizations of the district or of the province; so that the politicians may not impoverish the schools by appropriating to other purposes that portion of public funds that is necessary for the proper support of the schools.

h. Suitable legal provision should be made for supplementing the local school funds by provincial and national grants for aid to weak districts or for aid and stimulation in the establishment of educational activities that are vital to the interests of the whole province or the nation; and such funds should be distributed under wise regulations to be enforced through proper inspection and supervision under cooperative direction of the provincial Commissioner of Education and the National Ministry of Education.

5. Each city and its tributary or immediately adjacent territory should constitute a City School District with a City Board of Education and a City Superintendent of Schools, with a sufficient staff of supervisors and clerks.

a. The City Board of Education should be elected by the electors of the city district. Its members should be resident citizens of the city district. The composition, organization, and functions of this board, and of the superintendent and his staff should be similar to those described for the organization of the County School District.

b. The main financial support of the schools should be drawn from the taxes of the city district in accordance with the same principles that were described for the support of the county schools; and such supplementary funds as may be granted to the city district by the provincial or the national
government should be regulated in the same manner as heretofore described for the County School District.

This outline (sketchy and incomplete as it is, because of space limitations) is offered for reference and future study. It may be used in connection with the study of standard treatises on school systems as a guide in making from time to time such adjustments towards a thoroughly democratic system of school support and control as in the evolution of political adjustments may become feasible. It represents a combination of the features that have proved to be most successful in various states of the American Union, written with the background of the Chinese political and social conditions in view. Only a few states in America as yet have all the features here outlined. Unfortunately, there is no Department of Education in the United States government, corresponding to the Ministry of Education as here described. Also there is no national university. Many of the thinking educators have been agitating through many years for legislation establishing these two features.

For the encouragement of Chinese educators it may be interesting to note that America is still far from having a universal efficient school system; and that the tendency is towards such a system as is here described. The deficiencies of American schools are due chiefly to the fact that in most cases their control is too democratic, too much decentralized, while the schools of China are approximating towards a similar ideal from the opposite extreme. The schools of China are too bureaucratic and overcentralized. It will take time for both republics to reach an ideal system; and America, with her extreme localism and dislike of bureaucracy, may possibly turn out to be slower than China in achieving a universal perfected school system.
CHAPTER 9

THE CHINESE SYSTEM OF EDUCATION

I. THE OLD SYSTEM

For thorough comprehension of the problems related to scientific education in China we must add to the social, economic, and political background some knowledge of the evolution and present character of the educational system itself.

Prior to 1878, excepting those conducted by missionaries, there were in China no schools of the Western types. The existing Chinese schools were all privately supported by families or philanthropic individuals, or more often were conducted by private teachers on their own initiative as a means of livelihood. The main objective of such schools was to prepare candidates for passing the series of competitive civil service examinations, which were open to all classes of citizens and constituted the one road to high social standing and political preferment. The literatus, or scholar, was the highest social class, followed in order by the farmer, the artisan, the merchant, the soldier, and the laborer. Thus the examinations during more than a thousand years provided a road through which the influences of democracy might filter into an autocratic and bureaucratic government; and they also provided a path whereby the humblest citizen might rise to the highest social class. We have likened the examination system to a road; but it was not an open road with no barriers. It was closed along the way by a series of gates, through each one of which any one who had come thus far might proceed if he could give the required passwords; but the passwords, which were the acceptable
answers to the examination questions, were difficult to learn. Only those who were apt in learning could give them; and the tests at each gate were more severe than those required at the last one previously passed. Consequently, those who passed through each of the series of gates were fewer and abler than those whom they left behind them on the long and arduous road.

The examinations acted like a succession of sieves, each with a finer mesh than the one which preceded it; so the relatively small number of candidates who passed through the higher examinations were those who had the finest ability to pass examinations of the kind that was used.

Thus the examination system was a selective agency which picked out those who had the greatest literary ability irrespective of birth or wealth, and placed them in the positions of trust and responsibility under the government, in such a manner that the more important and difficult the position, the greater was the ability of the man who was assigned to it.

The system had its grave faults, and it was often vitiated or evaded by bribery; but it was founded on a wise and enduring principle. It created an aristocracy of learning, which, excepting for temporary setbacks, has been more powerful than the military class. It has prevented the rise of a hereditary ruling class and has checked the development of a caste system, both of which institutions have been the deadliest enemies of democracy in Europe and in other countries of Asia.

The basic faults of the system lay in the character of the examinations themselves, not in the principle upon which they were founded. Their worst result was that they were based exclusively on knowledge of books written in a dead language, which were long out of date, but were so enshrined by tradition and habit in the minds of the scholars, that no readaptations of their principles, and no reconstruction or revaluation of their content had been made. Consequently the content and method
of education were prevented from adapting themselves by variation and selection to changing conditions and to the newly discovered knowledges which filtered in from the West. China was bound by the examinations to a static civilization in a world wherein other nations were taking on, by an evolutionary process, a type of dynamic civilization which, in spite of its very obvious defects and crudities, is better than a static one just because it is dynamic, and capable, therefore, of progressive development.

The method in the old schools was memoriter, and the discipline harsh. Book knowledge was the only knowledge taught. Mastery of the content and style of the ancient classics was the only objective. The student had to gain his learning through the Wên-li or ancient classical language which is asserted to be as unlike modern Chinese as Latin is unlike modern English.

The young student committed his school reading books to memory without knowing at all what they meant. He had to find this out from his later teachers when he had become older. The ultimate goal of all his effort was to pass the higher examinations at Peking with as high a grade as possible; or failing in that, to pass through the examination gauntlet as far as he could go, and maintain the standing that he had gained. So, knowing the classics by heart, being able to quote from them at will relative to any topic, and being able to write readily literary and historical essays and poetry in the classical rhetorical style was the ability that led to official preferment and insured the highest social standing. Teaching consisted, therefore, in stimulating and assisting the younger students in the processes of memorizing and retention, and in tutoring the older students by explanation and precept in the art of composing with rapidity in the classical style. There was rarely if ever such a thing in education as training in logical thinking, the logical organization of the knowledge gained or the solving of practical problems through the use of general principles inductively arrived at.
The traditional modes and habits of teaching, fixed by tradition and the examination system through hundreds of years, constitutes one of the retarding factors which is preventing the rapid introduction of modern methods into the new school system. To one having this powerful static force clearly in view, it cannot seem strange that the modern methods have progressed so slowly during the thirty years since the inception of the new educational system. The wonder is that the philosophy of education and the methods of instruction are as good as we find them to be.

II. BEGINNINGS OF THE MODERNIZED SYSTEM

From 1878 to 1902, a few Chinese private schools came into existence, in which such subjects as arithmetic, geography, and some of the rudiments of science were taught; but the methods were the same as those of the old-type schools; so these schools were of little value, and made little impression on the situation.

The year 1902 marks the beginning of the new educational era in China. It was then that the first school code was issued by Emperor Kuang-hsü. This was replaced in 1903 by a new and modified set of regulations drawn up by a commission of three officials, one of whom was Chang Pei-shi, who as Minister of Education had prepared the first code.

The accompanying chart¹ (p. 106) shows at a glance the ambitious scheme which was promulgated.

The most remarkable thing about this scheme is its wide scope, and the number and variety of the institutions contemplated by it. Provision seems to be made for every kind of education needed in the state, excepting commercial training. There is a straight road from the kindergarten to the university and school of research, with opportunity

First Modern Educational System
1903

School of Research, 5 years

University, 3 or 4 years

Higher Industrial, 3 or 4 years 1 year Prep.

Higher School of Language, 5 years

Higher University Prep. School, 3 years

Higher Normal, 3 years

Industrial Teachers Training, 1–3 years

Chin Shih Kuan, 3 years

Middle Industrial, 3 years 2 years Prep.

Middle School, 5 years

Lower Normal, 5 years

Apprentice School, 1½ years

Primary Industrial, 2 or 3 years

Industrial Supplementary, 3 years

Higher Primary, 4 years

Lower Primary, 5 years

Kindergarten
for vocational training of various grades; so that youth at different ages and grades of ability may branch off and specialize in vocations at the highest levels which their economic resources and abilities permit them to reach.

A second remarkable feature, which makes the scheme cumbersome and wasteful, both educationally and economically, is the long time required to pass through the different grades of schools—twenty-one years from the lowest primary through the university, seventeen through the college, and fourteen through the middle (or high) school.

Probably the idea of consuming so much of the individual's time in school did not seem so strange to the Chinese mind as it does to the American, because the scholar in China belonged to a class set aside by tradition for the sole business of study. Every scholar spent his life in preparing for a higher examination, until he had passed the highest examination, or had attained to an official position, or, having failed so many times as to become impoverished or discouraged, had given up hope and dropped into some minor clerical occupation or become a private teacher. Cases are cited in which old men entered the higher examinations in Peking at the same time with their grandsons; so the idea of spending long periods of time in the new schools probably seemed to be in no way abnormal.

The tendency now in China, as it is in America, is towards increasing the efficiency of instruction and shortening the school period as much as may be consistent with thoroughness of training, in order that the student may become an independent producer at the earliest age at which adequate training for his life work can be completed.

The number of hours of class work a week, considered from the American viewpoint, was also abnormally large, giving the students insufficient time for study and reading outside the classroom. In the lower primary it was
thirty hours a week; and in the higher schools thirty-six hours a week. This overloading of hours of class work persists to the present day to a very great extent.

According to the program there was to be a national university in Peking and in the capitals of certain provinces, a college in every provincial capital, a middle school in every prefecture, a higher primary school in every town, and a lower primary school in every village. Kindergartens also were projected for all children below the age of seven, but even to-day these are rare except in connection with the government normal and the mission schools.

A third remarkable feature of the new school system was its rapid growth. According to the last statistics published (1911) by the imperial government,¹ the numbers of schools of different kinds, and the numbers of students enrolled in them were:

<table>
<thead>
<tr>
<th>KIND</th>
<th>NUMBER</th>
<th>STUDENTS ENROLLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>3</td>
<td>749</td>
</tr>
<tr>
<td>Colleges</td>
<td>25</td>
<td>4,525</td>
</tr>
<tr>
<td>Higher Normal</td>
<td>9</td>
<td>1,580</td>
</tr>
<tr>
<td>Higher Technical</td>
<td>13</td>
<td>1,690</td>
</tr>
<tr>
<td>Middle Schools</td>
<td>438</td>
<td>38,881</td>
</tr>
<tr>
<td>All Types of Schools</td>
<td>52,348</td>
<td>1,625,534</td>
</tr>
</tbody>
</table>

These figures speak for themselves; and when we take into consideration also the thousands of students who, during these years, flocked to Japan, America, and Europe we must credit both the Manchu government and the Chinese people with a very enterprising spirit and a very remarkable degree of achievement.

By 1905 it was found, however, that the new schools were not being used and supported by the people, and especially by the literary class, to the extent that was desired; and the reactionary tendency was attributed to the system of civil service examinations, in which the

¹ These figures are taken from Kuo, P. W., “Higher Education in China,” and Liao, S. C., “Middle School Education in China,” Bulletins 10 and 12, Vol. II, the Chinese National Association for the Advancement of Education.
new schools with their emphasis on modern subjects could not fit their students to compete. Accordingly, the examination system was forthwith abolished by imperial mandate; and the doom of the old system of examinations and exclusive study of the classics was sealed.

It is a pity that the system, with its strong incentives for study and its principle of selection according to ability, was thus totally wiped out. It should have been thoroughly reorganized and reformed on the basis of modern studies, adapted to the varying requirements of the different classes of official positions, and made sufficiently flexible to suit modern conditions, so that the incentive for study, and the democratic avenue to political preferment, might be preserved and combined with proper safeguards against corruption and favoritism.

It is to be hoped that a time may come when a new civil service examination system shall be set up, in which these advanced principles of selection will be applied. Such a system with suitable provisions for progressive modifications to fit changing conditions would serve as a stimulating and steadying influence on the educational system as well as a means of purifying the civil service.

III. Educational Progress Under the Republic

With the Revolution of 1911–1912 came a change in the school system which can be partly apprehended by comparing the accompanying chart (p. 110) with the preceding one (p. 106).¹

Under the imperial régime, the aim of education had been "to develop in the minds of the young generation the following virtues: loyalty to the emperor, reverence for Confucius, devotion to public welfare, admiration

¹ Copied from Liao, op. cit., p. 6.
Reorganized School System

1912

Normal School
- Preparatory
  - Normal School
    - Preparatory
      - Supplementary Courses
        - Higher Primary
          - Lower Primary
            - Industrial School B
              - Industrial School A
                - Middle School
                  - Preparatory
                    - University
                      - Preparatory
                        - Research Higher Normal School
                          - Preparatory
for the martial spirit, and respect for industrial pursuits." Under the new régime, it was to make education a means of cultivating virtuous or moral character or to instill into the minds of the people the right knowledge of liberty, equality, and fraternity, the moral training to be supplemented by industrial and military education, and rounded out by aesthetic education.

The principal changes in the system of education which took place at this time were such as to transfer the direct control of most of the colleges and the middle schools from the central to the provincial governments, to reduce very greatly the emphasis placed on the study of the ancient classics and increase the emphasis on studies of more practical value, to reduce the number of years required to pass through the different grades of schools, and to establish middle schools for girls. All these changes were made in view of the modification of the general aims of education towards objectives that logically are associated with a democratic régime.

During the decade from 1912 to 1922, a process of evolution and a development of initiative was steadily though slowly going forward within the schools, and the influence of returned students from America was gradually becoming stronger. A third factor which exerted a very great influence on educational opinion was the work of Drs. John Dewey and Paul Monroe, of Columbia University, New York, whose lectures and magazine articles on the philosophy of education and educational administration during their visits in China aroused great interest and were widely discussed by the newspapers, and in the schools.

By 1922, leading educators throughout the country had become thoroughly aware that the influences of the traditional memoriter method, which held over from the old régime, and the overcrowding of the curriculum were standing in the way of educational progress, and that further reforms were necessary. The result was a gradual drifting of educational opinion away from the
German types of school organization towards something more like the latest and best types of American state school systems. There was also a still stronger drift in theoretical opinion towards the adoption of the newer methods of instruction which have successfully passed the tests of actual use in America and England. With these, returned students from American colleges of education have become familiar, and are subjecting them to the tests of practical use in practice schools in China.

The problems of revision were taken up by the provincial educational associations; and plans for a new system were drawn up. These were presented, discussed, and perfected at conferences of the delegates from the provincial associations, the departments of education, and the colleges, held in 1921 and 1922. The proposed new system was formulated and presented to the Ministry of Education with the recommendation that it be adopted and put in force. On the other hand, a quite different plan was presented for review at the 1922 conference in Peking, called for this purpose, by the Ministry of Education. At this conference no reconciliation of the opposing views was effected, and no final decision was reached; but the problem was taken up at a convention of the educational associations held in Tsinan, Shantung, in November. The result was a reconciliation of the two plans which embodies the most important principles for which the associations contended. This coalition plan was presented to the Ministry of Education, and with a few verbal changes it was adopted and promulgated as the twenty-third ordinance by presidential mandate November 1, 1922.

The new system, to which the schools are beginning (1923–1924) to adjust themselves, is outlined and discussed by Dr. C. W. Luh in Bulletin 8, Vol. II, of the Chinese National Association for the Advancement of Education, Peking, 1923. The accompanying chart, taken from this monograph, presents the scheme of organization:
This scheme will be seen to resemble closely the American system, excepting in the case of the normal, vocational and technical schools. Amongst the American normal schools at the present time very few are found which do not give at least one year of professional training beyond the senior high school; and most of them give two or four. In China, the normal school is a middle (high) school, and as yet differs very little from the conventional middle school, while the higher normal school is a four-year college, more like the American state normal colleges, but with less tendency to differentiation of courses. The American vocational school, or trade school, corresponds more nearly to the junior high school grades; the technical school is still usually a four-year school.
including grades nine to twelve; and the higher forms of technical training are given in the four- or five-year technical colleges, of engineering, agriculture, pharmacy, etc., admitting only senior high school graduates. These are usually but not always associated as units of a university.

A careful reading of the ordinance establishing the new Chinese system reveals a remarkable degree of flexibility providing for changes that may be made by local initiative in accordance with local needs. It also reveals evidence of a fine ability to compromise between the defenders of the older system with its badly coördinated vocational, technical, and special schools, and the advocates of the modern comprehensive high school and university, in which better coördination makes for greater efficiency and economy, both educational and financial. The ordinance makes it possible for the progressive educators to advance towards better modes of organization and more modern methods. At the same time it allows the reactionaries an amount of freedom in holding to their accustomed organizations and methods which is sufficient to keep them from fighting the progressives and blocking their advances. This is characteristic of the Chinese genius for social adjustment; for the progressives know that in due time the reactionaries will either die off or become converted, in case they are not in the meantime forced out by pressure from the students; and their places ultimately will be taken by a new generation more capable of adapting itself to new conditions.

Dr. Luh has put the situation in a way that is so tersely characteristic of the good-natured and tolerant Chinese humor that I cannot forbear quoting it. He says: “Some critics are of the opinion that the new system is too much American, just as the old was too much Japanese. If the whole trend of our national life will drift in that direction, we have to admire the promoters of the new system for being prophetically intelligent.”
The aims of the new system as stated in the ordinance are: (1) to adapt itself to a changed and changing society, (2) to promote the spirit of democracy, (3) to develop individuality, (4) to take into consideration the economic status of the average citizen, (5) to adjust education to the needs of life, (6) to facilitate the spread of universal education, and (7) to make itself flexible enough to allow for local variations.

The new system permits the retention of the girls’ schools already established and also permits the schools and colleges to adopt coeducation, which is coming on naturally and easily now in not a few schools and even in the two big national universities. Whereas in 1902 the education of women in public schools was not even thought of, now public sentiment has so far advanced that the ordinance does not mention it, but for the very different reason that the eligibility of girl students to be admitted into every grade of school is now unquestioned. This is indeed a great and significant change to be accomplished in twenty years.

The ordinance permits the establishment of continuation schools, implies special provision to be made for bright and subnormal children, takes account of the probable present limit of economic ability in fixing the compulsory education limit at the end of the fourth grade, permits the establishment of supplementary schools for uneducated adults, provides for differentiated curriculums in the junior and senior middle schools, and the gradual incorporation of the old secondary industrial schools with the middle schools as agricultural, technical, and commercial departments, makes provision for elective courses, allows the admission of over-age retarded pupils from the primary grades into courses in the secondary vocational schools, permits group electives in the normal schools, and throughout the system permits every sort of reasonable variations for meeting local needs.

Finally, the ordinance provides for improving the organization of the colleges and also for reducing the normal
period required to pass the grades to twelve years for
the elementary and secondary schools, and four years
for the colleges.

In connection with these changes in the educational
code, if we also take into consideration the progressive
movements that are going on within the universities, the
teachers colleges, and also in a considerable number of
the middle and primary schools, it is not an overstate-
ment to say that the last two years' developments mark
the beginning of a new epoch in the educational history
of China.

Among the movements just referred to we may mention
as especially significant the introduction of intelligence
tests and educational measurements "made in China,"
and the beginnings of their use in connection with edu-
cational surveys and the testing of modern methods that
are being experimentally tried out. This movement has
received a great impetus and a notable set towards
greater thoroughness and scientific accuracy through the
cooperative work carried on under the direction of Dr.
W. A. McCall, of Columbia University, in 1922-1923,
and is being vigorously continued under the leadership
of Professor E. L. Terman, of Yenching University,
Peking, and the educationists of the government colleges
in Peking and Nanking. ¹

Individual laboratory practice in science, which until
very recently has been confined to the colleges, and
which even in them was somewhat rare, is now being
introduced into a few progressive middle schools, many
of which also are beginning to use the recitation method
and are teaching less exclusively by the lecture method.
Several schools are trying out the "Dalton Plan," a few
of them very intelligently and with careful discrimination
and checking of results.

¹ Terman and others have just published a report of a survey of the
schools of more than twenty cities of North, East, and Central China
with the use of the new Survey Tests (Commercial Press, Shanghai,
1924, Mex. $1.80).
Student participation in self-government is being tried out in a majority of the middle schools according to various types and plans, and in most cases with very encouraging results; the Boy Scout movement is "going strong"; and the Girl Scout enthusiasts have made a good beginning. Altogether, the situation looks very encouraging in spite of the many handicaps under which the school people are laboring; and notwithstanding the deplorable political conditions with which the schools are at present inextricably linked up, a hopeful view of the future is indicated.

It is at least safe to predict that more real progress in the quality of education will be made during the next ten years than has been made in the past twenty.

As to the future increase in the numbers of schools and pupils one cannot be so hopeful. Yet even with respect to this feature there is no ground for despair, as may be seen from the accompanying table, from which the reader may easily draw his own conclusions and make his own predictions:

<table>
<thead>
<tr>
<th>DATE OF REPORT</th>
<th>TOTAL NO. OF STUDENTS</th>
<th>NO. FEMALE STUDENTS</th>
<th>PERCENTAGE FEMALE STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906</td>
<td>468,220</td>
<td>306</td>
<td>0.07</td>
</tr>
<tr>
<td>1907</td>
<td>883,218</td>
<td>1,853</td>
<td>0.21</td>
</tr>
<tr>
<td>1908</td>
<td>1,144,299</td>
<td>2,679</td>
<td>0.23</td>
</tr>
<tr>
<td>1909</td>
<td>1,536,909</td>
<td>12,164</td>
<td>0.79</td>
</tr>
<tr>
<td>1910</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1911</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1912–1913</td>
<td>2,933,387</td>
<td>141,130</td>
<td>4.81</td>
</tr>
<tr>
<td>1913–1914</td>
<td>3,643,206</td>
<td>166,964</td>
<td>4.58</td>
</tr>
<tr>
<td>1914–1915</td>
<td>4,075,338</td>
<td>177,273</td>
<td>4.34</td>
</tr>
<tr>
<td>1915–1916</td>
<td>4,294,251</td>
<td>180,949</td>
<td>4.21</td>
</tr>
<tr>
<td>1916–1917</td>
<td>3,974,454</td>
<td>172,724</td>
<td>4.35</td>
</tr>
<tr>
<td>1917–1918</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1918–1919</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1919–1920</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920–1921</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921–1922</td>
<td>4,987,647</td>
<td>417,820</td>
<td></td>
</tr>
<tr>
<td>1922–1923</td>
<td>6,615,772</td>
<td>417,820</td>
<td>6.32</td>
</tr>
</tbody>
</table>
This table ¹ certainly represents a tremendous achievement; for be it remembered that this growth has taken place in spite of the disturbed conditions incident to two revolutions and a civil war. It is much to be doubted that any other country under similar circumstances would have done as well. With such a continuous pressure for more schools as is indicated by the increase of students during the last year, it is difficult to think that even in the present deplorable condition of China’s political and financial affairs there will be any permanent halt in the growth of the school system. It seems, therefore, fair to conclude that we may look forward to a steady increase in the number of schools, during the next decade, as well as to great and widespread improvements in the methods of teaching and internal administration.

CHAPTER 10
THE ELEMENTARY SCHOOLS AND
NATURE STUDY

I. RELATIONS TO THE SYSTEM
AS A WHOLE

SINCE the main purpose of my study of the Chinese school system has been the improvement of science teaching in the middle schools, and since the task has been one of almost overwhelming magnitude, it was not possible to visit many elementary schools. However, a few such schools were given brief visits in order that some knowledge might be gained as to what kind of foundation exists upon which the middle school teachers may build their instruction. Also at various points, the teachers and officers of certain elementary schools were so urgent in their invitations to visit their schools and give such advice as might be within my power to offer, that although my time was always very limited, these invitations were usually accepted. Probably the elementary schools personally visited are typical of the best and medium quality rather than of the poorest; and they represent too small a sampling to be used as a basis for reliable generalizations. Nevertheless, by supplementing my own observations with testimony and data from other sources, it is possible to make a few comments having some significance and value.

The accompanying table from H. T. Hsüeh's statistical study shows the numerical strength of the elementary schools in 1922–1923 as compared with the institutions of other grades:
<table>
<thead>
<tr>
<th>KIND OF SCHOOL</th>
<th>NO. STUDENTS</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>University and College</td>
<td>34,880</td>
<td>0.51</td>
</tr>
<tr>
<td>Normal School</td>
<td>38,277</td>
<td>0.56</td>
</tr>
<tr>
<td>Normal Institute</td>
<td>5,569</td>
<td>0.08</td>
</tr>
<tr>
<td>Middle School</td>
<td>118,598</td>
<td>1.74</td>
</tr>
<tr>
<td>Secondary Vocational</td>
<td>20,360</td>
<td>0.29</td>
</tr>
<tr>
<td>Elementary Vocational</td>
<td>20,467</td>
<td>0.30</td>
</tr>
<tr>
<td>Higher Primary</td>
<td>615,378</td>
<td>9.02</td>
</tr>
<tr>
<td>Lower Primary</td>
<td>5,965,957</td>
<td>87.48</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,819,486</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The numbers themselves are impressive; but the most significant thing is that 96.5 per cent of all the students in the system are in the elementary schools. The statement, frequently heard, that the Chinese system is top-heavy—that too much attention is being given to the higher schools in proportion to that given to the elementary schools— is evidently contrary to fact. When we remember that the teachers for these schools must be trained in the middle and normal schools, and that there are 262,340 elementary teachers, a considerable percentage of whom will drop out of the work each year and must be replaced, it is easy to see that the middle schools, the normal schools, and the normal institutes, which, taken together, enroll 162,444 pupils, are not likely to turn out more teachers each year than are needed for replacements in the elementary schools. It is a fairly safe guess that not less than five per cent, or approximately thirteen thousand, teachers will drop out; and it is not probable that more than ten per cent of the normal and middle school students (say about fifteen thousand) will graduate and become elementary teachers. Furthermore, many teachers will be needed to take care of the annual increase in elementary school enrollments. If universal compulsory education were established for the first four school grades as intended by the government plans, the number of teachers for the lower primary alone
would have to be increased by more than half a million, in order to provide one teacher for every fifty pupils. The minimum of training that the elementary teachers should have is represented by graduation from a middle or normal school; so it is evident that there are not too many such schools.

The conclusion to be drawn seems to be that, at the least, the present ratio of middle and normal schools to elementary schools should be maintained, and that for the present and until larger funds for educational purposes shall become available, the main effort should be to improve the equipment and the quality of instruction in both the lower and higher schools rather than rapidly multiply the number of elementary schools.

The financial support available for these elementary schools is very meager—a fact which goes to support the conclusion just stated. The average annual cost per school is, for higher primary, Mex. $985, and for lower primary, $124.¹ These schools are so numerous in proportion to the higher schools that even if the money now used for the latter were given over to the lower schools and distributed among them the resulting addition to their funds would still be insufficient for their proper support.

The accompanying table² (p. 122) shows that a little more than half the total expenditure for education goes to the elementary schools (Mex. $31,449,963), while a little less than half goes to the higher schools and colleges ($27,974,604). Hence the total abandonment of middle and higher education would result only in not quite doubling the amount available for the lower schools.

The per-student cost of the higher primary schools is now Mex. $17.32, and of the lower primary, $3.75. If these were doubled they would be $34.64 and $7.50,

² Hsüeh, H. T., op. cit., p. 3.
<table>
<thead>
<tr>
<th>KIND OF SCHOOL</th>
<th>NO. STUDENTS</th>
<th>EXPENDITURE ($ (Mex.)</th>
<th>PER-STUDENT COST ($ (Mex.)</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>University and College</td>
<td>34,880</td>
<td>13,950,424</td>
<td>399.95</td>
<td>1</td>
</tr>
<tr>
<td>Normal School</td>
<td>38,277</td>
<td>4,454,265</td>
<td>116.37</td>
<td>3</td>
</tr>
<tr>
<td>Normal Institute</td>
<td>5,569</td>
<td>179,654</td>
<td>32.26</td>
<td>5</td>
</tr>
<tr>
<td>Middle School</td>
<td>103,385</td>
<td>6,600,256</td>
<td>63.84</td>
<td>4</td>
</tr>
<tr>
<td>Secondary Vocational</td>
<td>20,360</td>
<td>2,790,005</td>
<td>137.03</td>
<td>2</td>
</tr>
<tr>
<td>Elementary Vocational</td>
<td>20,467</td>
<td>600,470</td>
<td>29.34</td>
<td>6</td>
</tr>
<tr>
<td>Higher Primary</td>
<td>582,479</td>
<td>10,089,731</td>
<td>17.32</td>
<td>7</td>
</tr>
<tr>
<td>Lower Primary</td>
<td>5,814,375</td>
<td>20,759,762</td>
<td>3.75</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,619,792</strong></td>
<td><strong>59,424,567</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

respectively. This would place these schools on a better basis; but the support of the lower primary still would be pitifully inadequate. If such increase were gained by destruction or serious impairment of the higher schools the result would be nothing short of an unspeakable national calamity; for, such as they are, these higher schools provide the only means of adequate training for teachers as well as the only means of training for every kind of leadership in the moral, scientific, and aesthetic development of China. In interpreting the table, another fact should be borne in mind; namely, that the relatively large expenditure for the middle schools and colleges is partly met by tuition fees, and also the college total includes that for the missionary colleges, which is not paid out of government funds.

According to Hsüeh’s report the average number of pupils per school is 56.9 for higher primary (grades five to seven) and 34.8 for lower primary; and the average numbers of pupils per teacher and officer are respectively 14.9 and 26. These low ratios indicate many small ungraded schools in the rural districts with ratios still smaller than these averages, and larger schools in the cities in which the corresponding ratios must be considerably greater than these averages. My personal observations were nearly all of city schools, most of which had a teacher and a room for each elementary grade, and a
few two teachers and two rooms for each of one or more grades; and cases in which the classes assigned to any teacher were overlarge were rare.

There is a tendency in nearly all the city schools towards overstaffing with administrative officers. The small pupil-to-teacher ratio is partly due also to the custom of employing teachers for part time and paying them by the hour. These conditions make for waste of funds and inefficiency of instruction wherever they exist.

Whereas under the former school systems the elementary schools had first nine grades, then eight, then seven, which most of them still have, a change to the 6–3–3 plan is now going on in accordance with the new code. So the more progressive schools are already in the process of changing to the six-grade basis for the elementary schools and incorporating the seventh grade with the junior middle schools.

II. THE ELEMENTARY CURRICULUM

The following outline of the elementary curriculum shows the subjects prescribed and the number of hours per week assigned to each, but as was explained in the preceding chapter, much latitude of variation is now allowed in order to suit local conditions:

<table>
<thead>
<tr>
<th>LOWER PRIMARY</th>
<th>HIGHER PRIMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADES 1–4</td>
<td>GRADES 5–7 (NOW 5, 6)</td>
</tr>
<tr>
<td>Moral Instruction</td>
<td>2</td>
</tr>
<tr>
<td>Chinese</td>
<td>10–14</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>5, 6</td>
</tr>
<tr>
<td>Chinese History and Geography</td>
<td>3</td>
</tr>
<tr>
<td>Science</td>
<td>2</td>
</tr>
<tr>
<td>Handwork or Manual Arts</td>
<td>Boys *7</td>
</tr>
<tr>
<td>Drawing (Beginning 2d Year)</td>
<td>*1, 2</td>
</tr>
<tr>
<td>Singing</td>
<td>4</td>
</tr>
<tr>
<td>Physical Drill</td>
<td>3</td>
</tr>
<tr>
<td>Agriculture (Beginning 2d Year)</td>
<td>Boys 2</td>
</tr>
<tr>
<td>Sewing</td>
<td>Girls 1, 2</td>
</tr>
<tr>
<td>English (Beginning 3d Year)</td>
<td>3</td>
</tr>
</tbody>
</table>

*May be omitted.
†Commerce may be substituted.
‡Optional—with another foreign language.
This curriculum shows the tendency towards overloading, which has been characteristic of the Chinese schools from the beginning. It is manifestly impossible to teach all these subjects in a school week and yet to get thoroughgoing work from the pupils. The program of studies, therefore, is largely a theoretical one, which is seldom followed out in practice. Especially in the weaker schools of the villages, most of the time is put in on the Chinese language and history, and little or nothing is done with the newer subjects. Also in the cities, where attempts are made to teach all the subjects, the teaching must necessarily be very superficial and the results poor. This inference is confirmed by observation in the schools. As would naturally be expected, the best work is to be found in the practice schools attached to the normal schools and teachers colleges. In a number of such schools I have seen some really very good work in Chinese reading and dramatization, in Chinese writing, in arithmetic (especially in practice with the abacus, which is used almost universally in Chinese business houses), and in sewing. There is some good drawing and handwork; but usually it lacks purpose, correlation, and system. I have not found in China outside of a very few of the technical schools, any evidence of a clear-cut theory of the teaching of drawing, color, and design. The same lack of definite objectives and well-organized methods for reaching them is characteristic also of most of the handwork and manual training.

III. NATURE STUDY, AGRICULTURE, AND GEOGRAPHY

The teaching of geography, agriculture, and science is purely formal bookwork—sometimes the teacher asks questions; but these are not thought-provoking; and if answered at all they are answered without thought, the pupils having little time for serious or thoughtful study. All their time is taken up in attending classes.
Usually the teacher occupies the entire time reading and explaining the textbook, a phrase or a sentence at a time; and there is no showing of pictures, specimens, or natural objects, nor any individual study of such things by the pupils.

In a few cases, teachers were observed who showed specimens or made demonstration experiments; but in such cases the teacher simply delivered a formal lecture, like those which are given nearly everywhere in the middle and normal schools; and the pupils had neither the desire nor the opportunity to react. No special effort was made by the teacher to make sure that all the pupils should see the significant features of the objects or experiments that he was showing.

A very good series of natural history readers written by Mr. N. Gist Gee, formerly professor of biology in Soochow University, now adviser to the China Medical Board on Premedical Education, is published by the Commercial Press. These are used as the basis of science lessons in many of the elementary schools; but they are intended to be only readers giving information supplementary to real observational and experimental lessons in science, and are in no sense a substitute for such lessons. The readers ought to be used for stimulating the pupils to go out into the fields, and to collect, examine, and study the natural objects that are everywhere about them. Also the readers should be useful in helping the teachers and pupils to understand these objects and learn their places and relations in the various classifications.

Some of the elementary schools have a more or less generous supply of charts illustrating natural history objects of the different classes—such as types of plants, animals, minerals, rocks, and some illustrations of physical and chemical apparatus and experiments. These, however, are not much used; and even where they are used they are not a substitute for the real objects. Like the science readers, they are useful only as
guides and stimulants to the study of the real things and as sources of a limited amount of supplementary information such as will help a little in classifying the real objects, and in organizing the information that is gained by observation with that gained by reading.

The procedures that have here been described are fairly representative of what is being done in science in the elementary schools that are well above average quality; and it cannot be called real nature study. It is not at all effective as a means of training in preparation for higher scientific study, nor yet as a means of arousing permanent interests in science. Neither does it contribute anything towards habits of thoroughness and exactitude of observation, manipulation, and thought, such as are essential to an understanding of the real meaning of science and of scientific investigation and problem solving.

It must be apparent, therefore, that there is great need for leadership by scientists to start a movement for reform in nature study teaching and to carry on the movement until the teachers become able to do better work. The practice schools provide the logical field in which better methods of teaching may be tried out and tested.

**IV. Need of a Program for Helping the Teachers**

There is great need of a national committee on nature study for the elementary schools, to plan and direct such experimentation in methods.

Most of these practice schools already are taking up school gardening; and this is a step in the right direction. Nature lessons given in connection with gardening projects will supply just the kind of training that is needed, about soils, fertilizers, tillage, seed selection, plant structure, plant growth, plant reproduction, preservation of food products and their preparation for use, insects injurious to
plants, insects useful to plants, uses of plant products for purposes other than food (i. e., clothing, shelter, fuel, medicine, perfumes, etc.), and the relations of plants to air, moisture, soil, and sunlight. The whole point is not merely to have the children read or hear about these relations, but to have them find out such relations themselves with the stimulation, guidance, and occasional help of the teacher.

The poor and ineffective teaching in geography, science, and agriculture is unquestionably due to two causes.

1. The almost entire absence in the normal and middle schools of laboratory and recitation instruction, in consequence of which these elementary teachers have received from these schools in which they were trained no real first-hand knowledge of the scientific method of observation, experiment, and inductive inference, and no experience of the recitation, laboratory, or project methods.

2. Due to the scarcity of trained scientists and educators, and to the fact that the few who exist in China have been so burdened with the duties of college and university teaching and administration, little or nothing has been done towards devising means of helping the present elementary teachers of geography, science, and agriculture to learn and use modern methods. They need ample, suggestive lesson leaves, teachers' handbooks, and information and helps of every sort; but there has been no one to tell them what to do and how to do it. Hence the need of the national committee that has just been suggested.

Such a committee ought to be one of a number (on nature study and agriculture for the elementary grades, general science for the junior middle schools, biology,
physics, chemistry, hygiene, training of science teachers, science teachers’ club, and general geography) composing a national organization for the improvement of science teaching, each division, or committee, being under a chairman who is a good leader and organizer, and is willing to do some hard work outside of his teaching program. Each committee should have charge of one branch of the science work, and they should all be federated in an executive council consisting of their chairmen. The executive council should be the coordinating and directing agency for the entire organization. The projects that should be undertaken by the division of nature study and agriculture for the elementary grades should be those which in their judgment will give the most effective assistance to the elementary teachers and principals in improving the nature study work in their schools. These projects will be such as the following:

1. Preparation of a series of lesson leaflets, each giving simple directions for the first-hand study of some common object of nature that is significant to the daily life of the children, the home, and the community. Such are the common garden plants and flowers, fruits and trees, the common soils, gravels, minerals and rocks, insects, birds, domestic and wild animals, the simplest applications of physics and chemistry that may be seen in the homes, in the shops, and on the streets, and the phenomena of the weather, stream erosion, etc. Such leaflets should be gathered from teachers, scientists, and naturalists in various parts of the country who are competent to write them.

Lesson leaflets needed.

2. The division, while preparing and collecting the manuscripts for such lesson leaves should be revising and editing them, and should also classify them into groups adapted to be used in the different grades of the elementary schools. These should be published from time to time without waiting to get together a complete set, the aim being to get at least a few good lessons into use as soon as possible, and continue publishing them until a complete and well-tried set for each grade is in use.
3. The division should prepare a manual of nature study teaching, to help and direct the teachers. It should outline a graded scheme of nature, agriculture, and gardening lessons for each of the six elementary grades, and should explain the best methods of conducting the lessons. It should contain directions for collecting, preserving, mounting, identifying, and labeling specimens for a school cabinet of natural history.

A nature study handbook for teachers.

It should tell how to conduct excursions with the pupils both for observing in the field and for collecting specimens to exchange with schools in other localities, and also for use in their own classroom study. It should also contain directions to help the teacher in his or her own study of local natural history objects, and directions for identifying specimens or for getting them identified by experts. It ought to help the teacher himself to become a naturalist on his own part by first-hand study.

4. Since the preparation of such a manual will take considerable time,—perhaps two years or more,—it would be well to issue the material in a series of brief bulletins. In this manner, various parts of the material will become available to the teachers as soon as they are written. This will give opportunity for revising the material before incorporating it in the completed volume. This plan also will keep up the interest of the committee and of the teachers while the work is going on, and the task of writing is not so likely to be put off, for in this way it will not seem to be so great.

5. Two American books contain much material that will be helpful and suggestive to the division in preparing the manual for teachers. They are (1) "Nature Study and Life," by C. F. Hodge, published by Ginn and Company, Boston, and (2) "The Teaching of Science in the Elementary Grades," by G. H. Trafton, published by Houghton, Mifflin Company, Boston. With reference to the promotion of science and the scientific method of solving the industrial and social problems of the nation, the enterprise of establishing an effective
system of nature study, beginning with the kindergarten and extending through each of the six elementary grades, assumes a position of great national importance. It is the only practical means of ultimately developing a scientifically minded people, convinced of the worth-whileness of doing things with accuracy and thoroughness and of thinking out problems by logical processes based on reliable evidence. It is the only hopeful means of spreading elementary scientific information and eradicating superstition among the uneducated farmers and artisans. In it lies the only hope of building up among the people a scientifically intelligent constituency which will give moral, financial, and political support to higher scientific teaching and research. Finally, it embodies the only means for preparing those students who will pass on through the middle schools and colleges to appreciate and profit by the scientific instruction that they may get in these higher institutions. It will be a great help to the higher schools, if their pupils come to them infected with a real taste for scientific study, with habits of thoroughness and exactitude at least partially formed, and with some really accurate information about nature already stored in their minds.

In considering this phase of education we must keep clearly in mind the figures quoted at the beginning of this chapter—96.8 per cent of all Chinese students in the elementary schools, and hence only 3.2 per cent in the higher schools. If elementary science is not effectively taught in the primary schools, then only 3.2 per cent of the student population will at any time be getting some scientific knowledge or training, and 96.8 per cent of them will be getting nothing whatever of such training.

To put this in a still more impressive way, there are three hundred fifty million people in China, about seventy million of whom are of school and college age. Of these, less than seven million—less than one in ten—are in schools and colleges getting any modern education at
all; and only about two hundred thousand
or one in three hundred fifty will be
getting any notions of what real science
is, unless there is competent teaching
of nature study in every grade of the
elementary schools! Is not this a challenge to the best
scientifically trained minds in this country? Their
problems of research, higher teaching, and administration
are indeed important and absorbing; but should not this
great and pressing need of the lower schools present an
appeal for a small share of their energy and a liberal
share of their spare time? Should it not be possible,
therefore, to get some of these trained scientific leaders
to form the suggested committee on nature study and
agriculture and at once begin work on such projects
as are outlined, for the assistance of the elementary
teachers? As a patriotic service I am of the opinion that
the importance of such an undertaking can hardly be
overestimated.  

V. ECONOMIC STATUS OF THE ELEMENTARY
TEACHERS

An attempt has been made to learn something of the
economic status of the elementary teachers. In 1921–
1922 Professor Tse-yi Yu, principal of the elementary
school of the National Southeastern University, Nanking,
sent out several thousand copies of a questionnaire for
this purpose. He got only 400 replies, 256 of which
were from Kiangsu province and the rest mainly from
contiguous provinces. There is little doubt that the
data from these replies represent a selection of the best
and most wide-awake teachers.  

The age range is from
18–56; median, 25.9; men, 26.4; women, 22.1. Very few
of the lady teachers were over 30. The median experience

1 A bulletin on this subject has recently been issued by the Chinese
National Association for the Advancement of Education (1924, No. 3).
II, the Chinese National Association for the Advancement of Education,
Peking, 1923, pp. 19, 20.
was 4.4 years. The mean initial salary was Mex. $125.10 per year, the mean present salary $160.25. Professor Yu estimates the necessary annual income for a man teacher with a wife and two children at $316.45, or for an unmarried man with two parents to support $218.95.

The mean salaries quoted are above the minimum of subsistence for a family of five persons in Peking, which, as determined by police and social workers, is $100. They are unquestionably far below the standards that are essential for maintaining a teacher and family in circumstances favorable to educational efficiency and professional growth.

As the costs of living are rather rapidly advancing in China, it is going to be necessary to pay the elementary teachers more, in order to keep in the schools such a class of persons as is at all capable of giving better service than is now given, or even of maintaining their present status. Without doubt nearly half the elementary teachers of China are living very close to the minimum level of subsistence; and the inevitable result of this condition will be that elementary teaching will become a temporary job rather than a professional vocation. This means that the quality of the service instead of improving will steadily deteriorate, unless better salaries are forthcoming.

From this rather gloomy topic we may turn to a more encouraging one with which to end this chapter, and may note the excellent progress that is being made in the provinces of Shansi and Kiangsu.

VI. Some Forward Steps

In Shansi, Tuchun Yen Sih-san, among other notable things that he is doing for good government in his province, is making a very persistent effort to carry out compulsory education through the fourth grade.

---

1 Gamble and Burgess, op. cit., pp. 268, 269.
Professor Cheng\footnote{Op. cit., pp. 5–7.} estimates the number of children to be in school under the compulsory education plan (one half the number of children of ages 6–14 to be in grades 1–4) as 100 per thousand, while Shansi had 69 per thousand in 1920 and 72 per thousand in 1922. This is nearly three times as large as the ratio of Shantung (25.5) and Chihli (2.42) and more than three times those of Shensi, Manchuria, Peking District, and Yünnan, which follow closely (23.1 to 20.6) and represents 72 per cent of complete accomplishment, if the reported returns are correct.

Kiangsu has not done so well on compulsory education; but is noteworthy for the part being played by the professors in the education department of the National Southeastern University, the Kiangsu Department of Education, and the Kiangsu Provincial Educational Association in experimenting with advanced methods of supervision and instruction and in working out a very much modernized manual of the elementary curriculum.

In several places, the “Dalton Plan” and the project method are being tried out, the recitation method is quite frequently and successfully used, and especially in Nanking such experiments in methods are being carefully supervised, studied, and tested by the educationists of National Southeastern University in their own practice elementary school, and also in other schools which they are supervising under the authority of the Commissioner of Education. The Commissioner has shown his wisdom and progressive spirit by availing himself of such trained and experienced assistance.

The new elementary curriculum outline which has been worked out by a special committee appointed by the conference of provincial educational associations in collaboration with the Kiangsu educationists is a highly creditable piece of work on thoroughly modern lines; and indubitably it will have a very marked and favorable
influence on the schools. It is pedagogically sound, sane, and practical, and is remarkably well balanced. It has the further merits (1) that it can be adopted and put in practice without conflict or confusion in respect to the curriculum now prevailingly in use, and (2) it is so outlined in chart form that any parts of it may be worked out in greater detail in supplementary charts without any rearrangement of the general outline. It may therefore lend itself admirably to a coöperative working out of detailed sequences of lessons in the different subjects for each of the grades. Any one may make a contribution at any point where his scholarship or experience is particularly strong.

This chart is accompanied with statements of minimum standards to be attained in the various units, and also by helpful explanations as to objectives and methods. With reference to science, the chart assigns twelve per cent of the time to gardening and nature study in the first four grades and eight per cent in the fifth and sixth. Also seven per cent is given to industrial arts and five per cent to drawing, color, and design throughout the six grades. This curriculum represents a very important step forward in elementary education, and reflects great credit on those who have so ably outlined it.¹

These evidences of progress taken together with the activity of the educationists in Nanking, Shanghai, Peking, and elsewhere, in the making and use of standard tests and in the conduct of special educational survey projects, give grounds for expectation of very hopeful progress during the next few years in the elementary school field. Such activity is injecting so much of interest into the occupation of elementary teaching that it may do much to attract and hold in the elementary schools many progressive spirits who otherwise might be driven out by the low salaries.

¹ The chart is reproduced and a discussion of the document is given, in the bulletin already cited, by Professor Cheng.
CHAPTER 11

THE MIDDLE SCHOOLS

I. BEGINNINGS AND GROWTH

The first middle school to be established in China under government auspices was started in connection with Nanyang College at Shanghai, when that institution was founded in 1898. There was no general movement towards establishing middle schools until 1902–1903, when the first imperial educational codes were promulgated. In 1904, there were 1,276 students in the middle schools that had been established by the government up to that time. In 1906, the number of students had increased to 31,289; and the teaching force numbered 2,888. By 1908, there were 438 middle schools enrolling 38,881 students.

The growth of the middle schools under the Republic is shown by the accompanying table:

<table>
<thead>
<tr>
<th></th>
<th>1912</th>
<th>1916</th>
<th>1922–3</th>
<th>%change 1912–16</th>
<th>%change 1912–22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Schools</td>
<td>373</td>
<td>350</td>
<td>547</td>
<td>– 6.2</td>
<td>+ 46.7</td>
</tr>
<tr>
<td>Number of Students</td>
<td>52,100</td>
<td>60,924</td>
<td>103,385</td>
<td>+17.0</td>
<td>+ 98.7</td>
</tr>
<tr>
<td>Number of Teachers</td>
<td>3,639</td>
<td>4,418</td>
<td>9,349</td>
<td>+21.5</td>
<td>+153.6</td>
</tr>
<tr>
<td>Per-Student Cost, Mex. $</td>
<td>58.2</td>
<td>59.9</td>
<td>63.8</td>
<td>+ 2.9</td>
<td>9.6</td>
</tr>
<tr>
<td>Students per School</td>
<td>139.7</td>
<td>174.1</td>
<td>189</td>
<td>+ 24.6</td>
<td>35.3</td>
</tr>
<tr>
<td>Students per Teacher</td>
<td>14.3</td>
<td>13.7</td>
<td>11.1</td>
<td>– 4.2</td>
<td>– 22.4</td>
</tr>
</tbody>
</table>

As is the case with most of the historical data in this chapter, this table is taken from Dr. S. C. Liao's "Middle School Education in China";¹ but the last two horizontal lines and the two vertical columns of percentages have been added to it in order that the interpretation may be easier.

These percentages show that (1) the number of schools diminished slightly during the first four years of the Republic; but that in the last six years the deficit has been wiped out and an increase of nearly one half has been made; (2) there was an increase in the number of students of about one for every six during the first four years; but in the whole ten-year period the number was almost doubled; (3) in the first four years there was an increase in the teaching force which added more than one for every five; while during the whole decade the increase was more than three for every two.

Considering the disturbed condition of the country politically, and the distressing state of its public finances, these facts indicate a most remarkable growth in the middle schools. This growth gives ground for a hopeful view of the future; because with improved training in the qualities of citizenship, to which the Chinese educators are giving more serious attention each year, we may expect these schools to turn out annually about ten thousand civically minded graduates. Many of these presumably will become civic leaders, and will exert a far better than average influence in the communities where they live. The result, of course, will depend on the quality of the moral and intellectual training that these graduates are getting; hence the great importance of making the teachers realize their heavy responsibility for giving the students the right kind of training in efficient civic, economic, social, and scientific leadership.

II. THE ENROLLMENTS ARE SMALL

This table shows also that the average enrollment of the schools is small, only 140 to the school in 1912, but increasing to 189 per school in 1922. This is an improvement, because small schools are uneconomical, and also educationally inefficient compared with competently administered schools having from five hundred to seven hundred students.
On the other hand, the number of pupils per teacher, which even in 1912 was too small for reasonable economy, steadily diminished from 14.3 to 11.1 during the ten-year period. This is a change of 22.4 percent in the wrong direction. It increases the cost of education per student as will be seen in the fourth horizontal line of the table; and it does not at all necessarily improve the efficiency of the instruction. The Chinese teachers as yet have not acquired the habit of giving their students the individual attention that is made possible by small classes. Furthermore, besides being costly, small classes do not afford to the pupils the inspiration that comes from coöperation in teamwork in classes of moderate size.

Among the middle schools personally visited by me were found many in which the ratio of pupils to teachers and officers was so small as to lie between 8 and 9. This is where the average lies for the Peking District and the four important provinces of Kiangsu, Anhwei, Fukien, and Chekiang.¹

These low ratios indicate waste, and should be seriously attacked by all who are seeking to bring about administrative reforms in the schools. It is safe and conservative to assert that at least half the middle schools, with good and efficient administration, might double or even triple the number of students they are serving without adding a single teacher or officer to the force they already have. This would mean that there might be an addition of from fifty to seventy-five thousand to the number of students now in middle schools in China without any considerable increase in the net cost of operation. It would require additional dormitory and refectory accommodations, because these schools are all boarding schools. It also would require some additional classrooms and some additional equipment; but the required increase in these

facilities would be far less proportionally than the increase in the number of students.

The best balance between cost per student and educational efficiency is usually obtained when the students average about twenty-five per teacher. This is the ratio which is generally taken as the standard in America, and it has been arrived at by a consensus of opinion based on much experience. A larger ratio makes large classes and reduces the cost per student, but impairs the educational efficiency. In very large classes, many students waste their time because they do not get needed individual attention. A smaller ratio gives more opportunity for contact between teachers and individual pupils; but it increases the cost per student and this in most cases without a corresponding increase in the efficiency of instruction.

Observation in the Chinese schools confirms me in the opinion that a ratio of twenty-five students to a teacher would be a good standard for them to work towards.

The general administrative policy should be to build up existing schools to enrollments of five hundred to seven hundred before starting new schools, and to let the ratio of students to teachers rise to about twenty-five before beginning to increase the teaching force, as the school grows.

Another point of importance to be noted from the table is that the cost per student would increase in the same ratio as that in which the ratio of students to teachers decreases, unless the salaries of the teachers are cut down. The table shows that the ratio of students to teachers has fallen twenty-two per cent, while the cost per student has risen less than ten per cent. This difference appears to be too great to be accounted for by other economies; and it therefore points to the conclusion that there has been a rather drastic cutting of the teachers' salaries. This is an inference which should be looked into, and either verified or refuted by a direct investigation; for
progress in educational efficiency is never maintained with a falling salary scale, especially during a time like the present in China, where the costs of living are said to be steadily rising.

III. Tendencies in Curriculum Administration

During the period from 1903 to 1911 a gradual change was taking place in the administration of the system. There was a tendency to set up differentiated curriculums in order to meet the needs of differing groups of students. Also there was a tendency to cut down the number of hours per week of required classroom work. These tendencies, though checked at times, have continued with slowly increasing strength to the present day, and represent substantial movements towards much-needed reforms.

At the beginning, the students’ weekly program of classes was so overloaded that it was impossible for them to do the work nominally required of them with any approach to thoroughness of mastery. Even at the present time, though some relief has been accorded, the attempt is still being made to teach the students more than it is possible for them to assimilate. It is not surprising, therefore, that they object to being examined, and give the teachers and administrators no end of trouble when attempts are made to test their knowledge. There will, in fact, be no cessation of these troubles until the unjust conditions which cause them have been removed.

One of the questions most frequently asked in my round-table conferences with the teachers was, “How can we change the attitude of the students, so that they will not be always trying to evade the examinations?” The answer is: first reform the curriculum so that the work required is no more than a diligent student of average ability can do successfully; second, reform the methods of teaching, so that the students may become more interested in learning and may be so directed as to learn more successfully;
third, give frequent short, and fairly easy tests, to habituate the students to the examination situation and to give the examination less relative weight in the final promotion standing. Students who know they are prepared for a given examination, and are used to passing tests and examinations successfully do not dread them. When, on the contrary, examinations are rare, and the students know they are not prepared for them by efficient training, they very naturally do everything they can to evade the examinations.

The accompanying table shows the curriculum of the middle schools which has been in effect since 1912:

**Curriculum of the Middle Schools, 1912-1923**

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chinese Language</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>History</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Geography</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Nature Study</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Physics, Chemistry</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Civics, Economics</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Drawing</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Handwork</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Music</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Household Arts, Gardening</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Sewing</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Physical Training</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

The first column under each year gives the number of hours per week of classroom work in each subject for that year in the boys' curriculum. The second column gives the number of hours per week for the girls only when it differs from the corresponding number for the boys.

This curriculum does not differ very much from that prescribed under the Manchu dynasty. The main differences are: (1) Chinese classics and literature were then assigned thirteen hours a week for the first two years, fourteen for the third, and twelve for the fourth and the fifth. Now the curriculum takes four years instead of five; and the classics are not studied. Only about half the number of hours a week is assigned to Chinese; and that is given
to modern language and literature. (2) "Nature study" which, as now carried on, is really a very condensed formal treatment of physiology, mineralogy, botany, and zoölogy, takes the place of formal biology of the college type. (3) The differentiation between the Classical or Literary and the Industrial or Scientific divisions of the curriculum, which was introduced in 1909, has been discontinued. (4) Handwork, mostly of the "sloyd" type, has been added in place of the classics. (5) Middle schools for girls have been organized, of which there were in 1915 three public and six private schools, with 948 girls enrolled. In 1923, there were 25 such schools with 3,249 girls enrolled. Most of the girl students of China are in the normal schools and the missionary girls' middle schools. (6) Under the imperial régime the number of hours a week of classroom work was uniformly 36. It is now reduced to 33, 34, and 35 for the boys and is 32, 33, and 34 for the girls. (7) Military drill, which was rather common under the old régime, is now rapidly giving way to the Boy Scout movement.

The new regulations already referred to as adopted in November, 1922, change the school system to the 6–3–3 plan of administration; but while this grouping of the grades is coming on steadily in the schools, few changes in the curriculum have as yet been made.

In the new regulations, the junior middle school curriculum is not differentiated; but it is permitted to offer some vocational courses, according to the needs of the community. In the senior middle schools, curriculum differentiation and electives are to be adopted according to the ability of the local authorities to provide for them. Such differentiation is to involve optional and free elective studies.

A committee of the Chinese National Association for the Advancement of Education has been at work for a year and a half on curricula for the junior and senior middle schools on the lines indicated. The plan for the junior school has been outlined; but its elements need much
more careful definition, description, and explanation than has yet appeared.

This outline\(^1\) prescribes the following as constants, with the exception of foreign languages (36 semester hours), which are made optional with "vocational" studies:

<table>
<thead>
<tr>
<th>I. Social Sciences: Civics, 6; History, 8; Geography, 8</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>II. Languages: Chinese, 32; Foreign, 36</td>
<td>68</td>
</tr>
<tr>
<td>III. Composite Mathematics</td>
<td>30</td>
</tr>
<tr>
<td>IV. Nature Study: &quot;General Science&quot;</td>
<td>16</td>
</tr>
<tr>
<td>V. Art: Drawing, Manual Training, Music</td>
<td>12</td>
</tr>
<tr>
<td>VI. Physical Training: Physiology and Hygiene, 4; Physical Exercise, 12</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>164</td>
</tr>
</tbody>
</table>

Less Foreign Language, 36, optional with Vocational Training | 36 |

**Total Constants** | 128 |
**Free Electives** | 16 |
**Optional (Foreign Language or Vocational Training)** | 36 |

**Total Units (Semester Hours)** | 180 |

One semester hour is here defined as one fifty-minute period a week for eighteen weeks. This scheme supplies an excellent apportionment of constants and variables for taking account of diversified interests and aims, while securing for all some general training that is fundamental to good citizenship and social efficiency. There is need, however, for much further work in elaborating the contents of the different courses and the proper methods of teaching them. This scheme also reduces the weekly program to thirty periods, or five a day for six days—a reduction of two to three hours a week as compared with the older middle school curriculum as shown in the preceding table.

It seems clear to me, however, that a still further reduction of required classroom recitation hours must be made before it will be possible to get the students to make adequate preparation by study outside the class-

---

rooms, and to substitute recitation and laboratory methods in place of the lecture method. However, if there is a thorough introduction of the supervised study system, the time for supervised study to be included within the prescribed weekly hours of class attendance, there can be no reasonable objection to the thirty-hour weekly requirement. On the contrary, with the provision for supervised study, the scheme will represent a very long step in advance. It is recommended, therefore, that the whole subject of "supervised" or "directed" study be given very serious investigation, with a view to its general introduction into the new junior middle schools.

The senior middle school program has not yet been worked out. As yet, the tendency seems to be of a somewhat doubtful character, tending rather towards the injection into the senior middle school of junior college subjects, instead of towards a reduction of the requirements set down on paper. The most glaring fault of the curriculums, heretofore, has been that of putting into the paper requirements more than any class would be able really to accomplish. The result has been that students, teachers, and the public have deceived themselves as to the amount of real education that the students were actually getting. All have ignored the fact that putting down requirements on paper is one thing and that getting the students actually to learn the things required is quite another thing.

In the past, the tendency has been to use college methods, college grade of subject matter, and even college textbooks to a very considerable extent in the middle schools, without any approach to real college thoroughness. Along this line, great harm has been worked against thoroughness in the middle schools by the ambition of the students to be studying higher subjects after the manner of college students, without first
gaining the necessary thoroughgoing knowledge of elementary principles. So, too, the teachers have worked harm in the same way by trying to teach the middle school students all that they themselves learned in college, while they should have been devoting themselves to the problem of getting the students to learn the elementary principles, upon which all successful college work and all successful application of knowledge to the solution of the problems of daily life must be based.

The National Association’s Committee on Middle School Curriculums is working very intelligently and sanely towards the correction of the defects that have been mentioned; and there is firm ground for hope that within a very few years a good curriculum philosophy, good curriculums with sufficient flexibility and thoroughness, and better teaching methods will come into use. A suggestive contribution towards the solution of the teaching and curriculum problems will be found in later chapters of this volume.¹

IV. THE STUDENTS

One of the greatest difficulties with which the middle school teachers have to contend is the wide variation in the ages of the students in every grade of these schools. This condition must be due largely to the variations in the quality and the quantity of the instruction afforded by the elementary schools in which the students are prepared. My observations lead me to believe that among the overage students the proportion of those who are retarded because of inferior intellectual endowment is not very large; so that most of the retardation must be due to poor preparation in the lower schools. This inference is supported by the accompanying table (p. 145), taken from Dr. Liao’s bulletin,² to which I have added columns 3 and

¹ Chaps. 13–17.
5. It will be seen that in most of the provinces less than sixty per cent of those taking the entrance examination have been admitted; hence with such drastic selection, it is not likely that many of those admitted are of inferior intellect.

Rather, their overage is due to inefficient instruction and failure to apply adequate incentives for making the students work hard in the lower grades. The difficulties for the middle school teachers arising out of this condition will continue to exist until the work of the lower schools has become much better than it now is.

**Showing the Number of Students Taking the Entrance Examination to the Middle School and the Number of Students Being Admitted in Different Provinces**

<table>
<thead>
<tr>
<th>Province or Special Administrative Area</th>
<th>Number of Students Being Admitted</th>
<th>Number of Students Admitted on Condition</th>
<th>Total Number Admitted</th>
<th>Number of Students Taking the Entrance Examination</th>
<th>Percentage of Applicants Admitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honan</td>
<td>101</td>
<td>22</td>
<td>123</td>
<td>460</td>
<td>23.7</td>
</tr>
<tr>
<td>Shensi</td>
<td>60</td>
<td>20</td>
<td>80</td>
<td>420</td>
<td>19.2</td>
</tr>
<tr>
<td>Hupeh</td>
<td>111</td>
<td>34</td>
<td>145</td>
<td>365</td>
<td>34.1</td>
</tr>
<tr>
<td>Kwangtung</td>
<td>54</td>
<td>9</td>
<td>63</td>
<td>361</td>
<td>17.4</td>
</tr>
<tr>
<td>Kwangsi</td>
<td>88</td>
<td>19</td>
<td>107</td>
<td>358</td>
<td>29.9</td>
</tr>
<tr>
<td>Hunan</td>
<td>126</td>
<td>12</td>
<td>138</td>
<td>334</td>
<td>41.4</td>
</tr>
<tr>
<td>Kiangsu</td>
<td>90</td>
<td>16</td>
<td>106</td>
<td>303</td>
<td>35.0</td>
</tr>
<tr>
<td>Yunnan</td>
<td>120</td>
<td>40</td>
<td>160</td>
<td>285</td>
<td>56.1</td>
</tr>
<tr>
<td>Chekiang</td>
<td>100</td>
<td>30</td>
<td>130</td>
<td>283</td>
<td>63.7</td>
</tr>
<tr>
<td>Shansi</td>
<td>79</td>
<td>33</td>
<td>112</td>
<td>245</td>
<td>45.7</td>
</tr>
<tr>
<td>Shantung</td>
<td>85</td>
<td>15</td>
<td>100</td>
<td>233</td>
<td>42.9</td>
</tr>
<tr>
<td>Szechwan</td>
<td>70</td>
<td>15</td>
<td>85</td>
<td>187</td>
<td>45.5</td>
</tr>
<tr>
<td>Peking</td>
<td>95</td>
<td>12</td>
<td>107</td>
<td>160</td>
<td>66.7</td>
</tr>
<tr>
<td>Kwangsi</td>
<td>60</td>
<td>50</td>
<td>110</td>
<td>155</td>
<td>71.0</td>
</tr>
<tr>
<td>Fengtien</td>
<td>53</td>
<td>12</td>
<td>65</td>
<td>120</td>
<td>54.2</td>
</tr>
<tr>
<td>Chihli</td>
<td>48</td>
<td>17</td>
<td>65</td>
<td>112</td>
<td>58.1</td>
</tr>
<tr>
<td>Anhwei</td>
<td>32</td>
<td>8</td>
<td>40</td>
<td>93</td>
<td>43.0</td>
</tr>
<tr>
<td>Fukien</td>
<td>52</td>
<td>8</td>
<td>60</td>
<td>87</td>
<td>68.9</td>
</tr>
<tr>
<td>Heilungkiang</td>
<td>87</td>
<td>—</td>
<td>87</td>
<td>87</td>
<td>100.0</td>
</tr>
<tr>
<td>Kingchao</td>
<td>40</td>
<td>40</td>
<td>80</td>
<td>80</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Professor Liao uses this table to show that the middle schools are too few in number to provide accommodations
for the number of applicants. However, fairly conclusive evidence has been given in this chapter to support the opinion that the number of middle schools for boys is sufficient to supply the instruction for all applicants in most of the provinces without much additional cost for operation, provided the existing dormitory and subsistence departments be sufficiently enlarged. This ought to be easily feasible; because these departments ought to be so managed that with reasonable fees from the students for rooms and board they would yield not only enough revenue to clear expenses, but also a small surplus. This surplus would provide interest and sinking fund to pay off the debt that would be incurred by borrowing the funds to enlarge these departments.

From many sources within and without the schools there is coming a great deal of pessimistic talk about the unruliness and turbulent character of the students, for which I am able to find no sufficient justification. I do not believe that there can be found anywhere in the world a body of students who are more reasonable or easier to control than those of the middle schools in China, when they are understood and are wisely and tactfully dealt with. The problem of controlling them turns first of all on providing plenty of worth-while classroom and laboratory tasks to engage their thought and attention, and on requiring that they make adequate preparation outside the classrooms for honestly and thoroughly accomplishing their assignments. Next to this and just as important is the provision for occupying their leisure time by profitable games, recreations, and extra-curricular activities of a co-operative nature. These will engage their interest and provide an outlet for their surplus energies, as well as afford them training in teamwork and individual self-expression. Next, and no less important, is the necessity for removing the causes of strikes and mutinies within the schools, by rooting out all sources of incompetency and injustice from the teaching and management.
If the students were always handled with thoroughgoing justice and fairness, and if every incompetent were removed from the administrative and teaching staffs, troubles with the students would be much less frequent than they are. Too often when they rebel, there is some real injustice at which they are trying to strike. Finally, they can be taught self-control and orderliness through education in the principles of good citizenship applied directly to their life in the school. It is a pleasure to record that in very many of the schools good teaching of this kind is being done in connection with various plans for student participation in self-government, and in many cases with very gratifying success. Understanding, sympathy, just treatment at all times, firmness, and provision for plenty of interesting and significant work and play will solve this problem of student control. Further suggestions along these lines will be made in later chapters.

The problem of getting the students’ cooperation in learning that which they are expected to learn is largely the problem of improving the methods of instruction. If the curriculum requirements are reduced to a reasonable amount, if the subject matter and problems set for the students are such as are suited to their present and future needs, if the methods of teaching are such as to show the significance of the studies and to make a reasonably attractive appeal to their interests, it is my belief that the great majority of the students will respond with diligence and success. This opinion has been formed by watching their reactions in many classrooms to the various acts of teachers in presenting the subject matter to them.

In almost all cases in which it was observed that the teachers presented the work well, the students did respond with good will, good interest, and good attention. Moreover, when they had an especially good teacher, they knew it and were manifestly proud of him.

Personally, I found the Chinese students most inspiring to address, even through interpreters; and if I only had
command of their language, I am sure that I could have as good success in teaching them as I ever have had with American students, and would enjoy working with them just as much.
CHAPTER 12

THE TEACHERS OF THE MIDDLE SCHOOLS—THEIR QUALIFICATIONS AND SALARIES

I. PERSONAL QUALITIES

ONE of the most noticeable characteristics of the teachers is the very general prevalence among them of good and even attractive personality. Good voices, winning and courteous manners, neat attire, and complete composure and self-control are characteristic of nearly all of them. They are very dignified; but they almost never frown, and they often smile. The Chinese smile is irresistible and is a great lubricant in the classroom. It is very creditable to both teachers and students, that in spite of all the talk one hears about the turbulence and disorderliness of the students, good order and decorum in the classrooms is almost universal. In my visits in hundreds of classes in ten different provinces I saw no breaches of good order. There is no question that the students are often beyond control, but the trouble is not in the classrooms or laboratories. If there had been habitual disorder in any of the schools visited I should certainly have seen evidences of it; because I had many opportunities, of which I took advantage, to look into classrooms without either students or teachers being aware that I was observing them.

The good order during class work is probably due largely to the fine personality of the teachers, who with respect to this very important qualification compare very favorably with the best teachers I have known anywhere.
The teachers very generally are of good native intellectual ability and give every evidence of averaging as well with regard to this trait as the middle school teachers of any country. They are far less skilled and resourceful in many matters of teaching technic than most of the teachers in American city high schools, but this, in my judgment, is due largely to the difference in the circumstances and conditions under which they work and still more to the difference in their training. Many of them are much more highly proficient in some of the best phases of lecture technic than most American teachers, while in other important phases of the lecture method, and even more in all phases of other methods, they are decidedly at a disadvantage, because it is in just those features that their training has been faulty. Their defects in teaching methods are not due to lack of intelligence. If they can have proper opportunities for making up their deficiencies in training, I can entertain no doubt that a majority of them would teach as well and effectively as secondary teachers of any country in the world. They are certainly remarkably open-minded and very anxious to do good work.

Another excellent trait quite frequently found among the teachers is open-mindedness. Evidence of this was very convincingly shown by the teachers in several cities in connection with my lectures on the improvement of teaching methods. Wherever it was possible, I arranged to address a mass meeting of all the teachers in the city, near the beginning of my visit; and in every case it was noticeable during subsequent visitation in the schools that the teachers were frankly trying out many of the methods that had been suggested in the lecture for the improvement of their teaching technic. In such cases, the teaching that was observed after the lecture was usually very noticeably better than that observed before the lecture. In some individual cases there was a really surprising improvement, which was proof not only that
these teachers are remarkably open-minded and hospitable toward suggestions, but also that they are marvelously quick and apt in grasping and applying ideas that are new to them. It is fair, therefore, to infer that if means are provided for giving the experienced teachers excellent modern training in methods of teaching and experimenting, they will grasp the opportunity eagerly and will profit by it to such an extent as to bring about rather quickly a very considerable change for the better in the methods of science teaching in the schools.

II. EDUCATION AND TRAINING

The teachers in the middle schools are required to be graduates of the higher normal schools of China, or to have had acceptable equivalent training in collegiate institutions of China or other countries. Considering the rapid growth of the middle schools, this requirement seems to be remarkably well enforced. There seems to be very little disposition to evade it. In my visits in the schools, I paid particular attention only to the science teachers; but among these it was a rather rare exception to find one who was not a graduate of a higher normal school or a fairly reputable college.

In order to get some definite and first-hand information about the science teachers, I prepared a rather comprehensive questionnaire, which was printed in both English and Chinese. Through the Statistical Department of the National Association this was sent out to all the government middle schools and colleges and to all the private and missionary middle schools and colleges that are institutional members of the association, or any of whose teachers are individual members. Two follow-up letters were sent out to the schools whose teachers did not reply. A total of about three thousand questionnaires were sent out. Replies were received from one hundred thirty-six science teachers in sixty-five middle schools. These replies represent a little more
than ten per cent of the middle schools and probably about ten per cent of the total number of science teachers. The replies have been translated and tabulated for me by Mr. H. T. Hsüeh, dean of the Statistical Department of the Association, and his assistants, and from these forms I have made distribution tables from which some information may be obtained about the one hundred thirty-six middle school science teachers who replied. The information cannot be regarded as thoroughly representative of the whole body (1) because ten per cent is too small for a reliable sampling; (2) because this is to some extent a selected group. The group includes definitely only those who would reply to our questionnaire. The unreliability of the statistics is further increased by the vague and equivocal character of some of the replies. Considerable inaccuracy is to be expected in the replies, because filling out questionnaires is a new experience for most of the teachers. This, so far as I know, is the first attempt in China at a country-wide investigation of any educational question by questionnaire directed to individual teachers. It is perhaps as successful as we could have expected, but far less so than we could wish. The results will appear hereafter and may be taken for what they are worth. They are worth more than otherwise they would be because of my extensive observations in the schools, which enable me to check up my interpretations with the results of personal inspection.

In the accompanying table (p. 153) is shown in horizontal distribution the number of teachers who reported getting their highest training in middle or normal school, in higher normal school, in college or technical institute, or in university.

The vertical distribution shows in each of the above classes the number of teachers who has had the number of years' total training (beyond the elementary school) that is indicated at the left end of the line in column 1. Thus, line 5 from the top may be read as follows: eleven teachers reported having a total of from five up to six
years' training beyond the elementary schools; and of these, three had their highest training in middle schools, six their highest training in higher normal schools, none in colleges, and two in universities.

There is much lack of clearness in the distinction between college and university, so the differentiation made by columns 4 and 5 is not of much significance. Columns 2 and 3, however, represent institutions which are well defined and are distinguished from each other and from colleges or universities by their names.

The table shows that of the one hundred thirty-six who replied, sixty-nine report less than eight years' training above elementary school. The condition, however, is certainly better than this, because graduation from middle school (four to five years) is one of the requirements for entrance into all the higher institutions. It is highly improbable, therefore, that so large a

<table>
<thead>
<tr>
<th>YEARS OF TRAINING</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDDLE OR NORMAL SCHOOL ONLY</td>
<td>MIDDLE OR NORMAL SCHOOL ONLY</td>
<td>HIGHER NORMAL OR TEACHERS COLLEGE</td>
<td>COLLEGE OR TECHNICAL INSTITUTION</td>
<td>UNIVERSITY</td>
<td>ALL</td>
<td></td>
</tr>
<tr>
<td>Less than 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>2 up to 3</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>3 ,, 4</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4 ,, 5</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>5 ,, 6</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>6 ,, 7</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>7 ,, 8</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>8 ,, 9</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>9 ,, 10</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10 ,, 11</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>11 ,, 12</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12 ,, 13</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13 ,, 14</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14 ,, 15</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>5</td>
<td>74</td>
<td>27</td>
<td>30</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>PERCENTAGES</td>
<td>3.7</td>
<td>54.4</td>
<td>19.8</td>
<td>22.1</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
proportion of exceptions could exist as is here indicated. Probably many of these apparent exceptions are those who failed to report the number of years spent in middle schools.

On the other hand, quite a number report four years in middle schools and less than four in the higher institutions, so they must have been engaged without having completed their courses for graduation from the higher institutions.

The absence of degrees does not prove this, since only a few of the institutions give degrees but give only diplomas or certificates. All things considered, including personal inquiries in the schools, it seems probable that the requirement of training equivalent to completion of four years in higher normal or college is much more strictly adhered to than this table indicates. The most significant item in the table is that only 3.7 per cent report having middle school training only, all the rest claiming at least two years of training in higher institutions. I believe this is near the correct proportion for the science teachers generally.

The large proportion trained in the higher normal colleges (54.4 per cent) I judge to be not far from representative as inferred from the schools personally visited, although it has been suggested that those trained in the normal colleges would be likely to fill the questionnaire in larger proportion than would those trained in the colleges,—because their normal training would better enable them to appreciate its significance. Another factor that would work in this same direction is that the colleges and college students are so much more numerous than the higher normal schools and higher normal students. We should therefore expect the former to provide the most of the teachers. Against these arguments it may be urged that relatively few of the former class of students enter colleges with the expectation of teaching, while nearly all those entering the higher normals expect to enter the teaching profession; and all are required to sign a contract to teach for six years after graduation.
There is reason, therefore, to expect that nearly all the graduates of the higher normals will teach in middle schools, while only a small proportion of the graduates of colleges and universities will do so.

Other things being equal, the higher normal graduates will tend to use better methods of teaching, because of the pedagogical instruction received in them. The colleges and universities for the most part take very little interest in teaching and administration or in the problems of the middle school, and pay very little attention to them.

The seventy-four who attended higher normal schools but not colleges or universities are distributed according to institutions attended as follows:

<table>
<thead>
<tr>
<th>Institution</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peking National, 19</td>
<td></td>
</tr>
<tr>
<td>Nanking, 9</td>
<td></td>
</tr>
<tr>
<td>Wuchang, 9</td>
<td></td>
</tr>
<tr>
<td>Shantung, 6</td>
<td></td>
</tr>
<tr>
<td>Chihli, 5</td>
<td></td>
</tr>
<tr>
<td>Peiyang, 5</td>
<td></td>
</tr>
<tr>
<td>Shansi, 3</td>
<td></td>
</tr>
<tr>
<td>Liang Kiang, 3</td>
<td></td>
</tr>
<tr>
<td>Szechwan, 2</td>
<td></td>
</tr>
<tr>
<td>Hunan, 2</td>
<td></td>
</tr>
<tr>
<td>Honan, 2</td>
<td></td>
</tr>
<tr>
<td>not named, 2</td>
<td></td>
</tr>
<tr>
<td>Liang Hu, 2</td>
<td></td>
</tr>
<tr>
<td>Shen Yang, 1</td>
<td></td>
</tr>
<tr>
<td>Pei Tsai, 1</td>
<td></td>
</tr>
<tr>
<td>Paotingfu, 1</td>
<td></td>
</tr>
<tr>
<td>Pa Chi, 1</td>
<td></td>
</tr>
<tr>
<td>Tsao Tao Tien (Japan), 1</td>
<td></td>
</tr>
<tr>
<td>The Nanking Higher Normal</td>
<td></td>
</tr>
<tr>
<td>Normal has now been converted into</td>
<td></td>
</tr>
<tr>
<td>the Teachers College of the National</td>
<td></td>
</tr>
<tr>
<td>Southeastern University, and has</td>
<td></td>
</tr>
<tr>
<td>been very much strengthened in</td>
<td></td>
</tr>
<tr>
<td>efficiency. Much more can be</td>
<td></td>
</tr>
<tr>
<td>expected of it in the future than it</td>
<td></td>
</tr>
<tr>
<td>was able to do before the</td>
<td></td>
</tr>
<tr>
<td>organization of the university</td>
<td></td>
</tr>
<tr>
<td>four years ago.</td>
<td></td>
</tr>
</tbody>
</table>

Of the thirteen who report that they hold college or university degrees the distribution is as follows:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. A. Peking National University</td>
<td>3</td>
</tr>
<tr>
<td>Peking University (union missionary)</td>
<td>1</td>
</tr>
<tr>
<td>Chihli Technical College</td>
<td>1</td>
</tr>
<tr>
<td>Hsei Wen College</td>
<td>1</td>
</tr>
<tr>
<td>College not named</td>
<td>1</td>
</tr>
<tr>
<td>B. S. Pennsylvania State</td>
<td>1</td>
</tr>
<tr>
<td>Kin Ling College, Peking District</td>
<td>1</td>
</tr>
<tr>
<td>University of Nanking</td>
<td>1</td>
</tr>
<tr>
<td>M. E. Colorado state and 1 year</td>
<td>1</td>
</tr>
<tr>
<td>postgraduate at University of</td>
<td>1</td>
</tr>
<tr>
<td>California</td>
<td>1</td>
</tr>
<tr>
<td>B. Agr. College not named</td>
<td>1</td>
</tr>
<tr>
<td>M. S. University of Upsala, Sweden,</td>
<td>1</td>
</tr>
<tr>
<td>and B. A. from Gothanberg Normal</td>
<td>1</td>
</tr>
<tr>
<td>School</td>
<td>1</td>
</tr>
</tbody>
</table>

Total reporting college degrees        | 13     |
Per cent that these are of the whole   | 9.5    |
number reporting                       |        |
The colleges and universities which were attended by those reporting college or university attendance are listed below with the number of times each was named. Some of those reporting have attended more than one institution:

<table>
<thead>
<tr>
<th>NUMBER OF TIMES ATTENDANCE WAS REPORTED</th>
<th>NUMBER OF INSTITUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Kwang Wen University, National Peking University</td>
<td>2</td>
</tr>
<tr>
<td>4 Shansi University, Huei Wen University</td>
<td>2</td>
</tr>
<tr>
<td>3 Shantung Christian University</td>
<td>1</td>
</tr>
<tr>
<td>2 Chihli Technical College, Tsao Tao Tien University, Japan, Kin Ling University</td>
<td>3</td>
</tr>
<tr>
<td>1 Chihli Agricultural College, National Agricultural College, Honan Agricultural College, Shansi Agricultural College, Kiangsi Agricultural College</td>
<td>5</td>
</tr>
<tr>
<td>1 Kiang Nan Industrial College, National Peking Technical College, Tientsin Technical College, Pei Yang University, Conservancy Engineering College</td>
<td>5</td>
</tr>
<tr>
<td>1 Peking Union Medical College, Army Medical College</td>
<td>2</td>
</tr>
<tr>
<td>1 Peking Customs College, Tsing Hua College</td>
<td>2</td>
</tr>
<tr>
<td>1 Shanghai College, Peking University, University of Nanking, William Nast College</td>
<td>4</td>
</tr>
<tr>
<td>1 University of Upsala, Sweden, Colorado School of Mines, U. S. A., University of California, U. S. A.</td>
<td>3</td>
</tr>
<tr>
<td>1 Agricultural college not named, 1; military college not named, 1; other college not named, 4</td>
<td>6</td>
</tr>
</tbody>
</table>

This table gives some indication as to the kinds of institution and the particular institutions from which the middle schools have drawn their teachers, aside from the higher normal schools or teachers colleges. It is, however, too unreliable to base any general conclusions on, since the fifty-seven out of one hundred thirty-six science teachers who reported is both too small a proportion of the ten hundred to fifteen hundred middle school science teachers, and too much subject to the selective influence of the questionnaire, to be taken as a representative sampling.

The distribution is interesting, however, as showing the relatively great number of institutions from which these fifty-seven men have been drawn, and as indicating the tendency of graduates in science and technology
from Peking National University and the technical, engineering, and agricultural colleges to drift into science teaching in the middle schools. This is largely due to the fact that as yet there are insufficient openings in technical lines to absorb the graduates of these departments and technical colleges; so many of them turn to teaching in the middle schools. This is good for the middle schools just in the proportion that the scientific and technical training of these graduates, and the quality of the graduates themselves is good. If they are able and well trained in science it is good for both them and the schools that they should spend some years in teaching science to middle school boys while waiting to get into industrial positions, provided that in the meantime they take their teaching work seriously, and give their best talents and energies to it.

III. EXPERIENCE

The accompanying table (p. 158) shows the distribution of (a) 133 of the teachers according to the numbers of years of their total experience in teaching and (b) the distribution of 128 teachers according to the numbers of years they have taught in the schools in which they were teaching when they reported. As to total service, it will be seen that there is a prevailing variation between part of one year and sixteen years (one has served nineteen years and another thirty-two years). The mode is two up to three years; that is to say, two to three years represents the term of service most frequently reported.

The median is 6.2 years. This means that half the teachers reporting have served for more than 6.2 years and the other half for less than that time.

The four undistributed cases not reporting on this item probably belong in the group who are teaching in their first year. Assuming this, the median would be almost exactly 6 instead of 6.2.
Distribution of Middle School Teachers According to Total Years of Service, and According to Years of Service in the Schools Where They Are Now Teaching

<table>
<thead>
<tr>
<th>Numbers of Years of Service</th>
<th>Total</th>
<th>In This School</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 up to 1</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>20 or more</td>
<td>113</td>
<td>128</td>
</tr>
</tbody>
</table>

Medians: 6.2
Modes: 2 up to 3
Not Reporting: 4

The mode for experience in the school where now teaching is 1 to 3 years; and the median stay is 2.6 years. If the nine undistributed cases were included as among those in the first year in their respective schools, this would bring the median down to 2.3 years. Only one person has taught in any one school longer than thirteen years; and he is in his fourteenth year with that school.

It will be recalled that the first government middle schools were started in 1903; so the limit of possible service is twenty years. Even with this fact in mind, these figures indicate that the term of service in middle schools is
relatively short. *This is a condition which should be investigated with a view to remedial measures; for permanency of the teaching force is one of the necessary conditions for the development of good schools.*

Of 137 teachers, 58 report that they have had experience in elementary school teaching ranging from $\frac{1}{2}$ year to 10 years, 41 report experience in teaching in normal schools ranging from $\frac{1}{2}$ year to 10 years, 4 report experience in higher normal schools ranging from 1 year to 4 years, and 12 report experience in college or university teaching of from $\frac{1}{2}$ to 3 years.

Such experience in elementary schools may reasonably be expected to have contributed some important elements to the efficiency of the teachers who have had it. They are less likely to pitch their instruction at too high a level for middle school students if they have had some successful experience in teaching younger children.

**IV. SALARIES**

In the table presented herewith (p. 160), it is shown how the teachers who answered this part of the questionnaire are distributed (a) according to the annual salaries received from the schools in which they are teaching, and (b) their total incomes derived from teaching, which in many cases are received from two or three different schools.

The table shows that teaching incomes above $1,100 Mex. are very rare in middle schools, the mode being 600 to 700. The 16 and 12 cases of salaries and incomes below $400 probably represent persons teaching only part of their time. Those receiving over $400 probably teach full time, but some of them in two or three different schools.

For the 82 teachers who reported on these items the median salary received from the school from which the teacher reports is $612.50 and the median total teaching income is $625.
The salaries of $400 to $900 are all above the minimum economic level; but the margin is far too small. This should be appreciated when we remember that these teachers must put in a minimum of eight years in training above the elementary schools, that books and attendance on summer schools and teachers' conventions are relatively very expensive, that teachers to be efficient and socially acceptable must have convenience in their homes for proper living and for the pursuit of scholarly activities, and finally that it is a matter of vital import to the state as well as themselves that their children be given the best of education. All these things cost money,—more money than these salaries,—and all or part of them must be sacrificed by a teacher who remains in the middle school on such a meager stipend.

### Distribution of Middle School Teachers According to Salaries in Their Schools and According to Their Total Teaching Incomes

<table>
<thead>
<tr>
<th>_salaries mex. or chinese dollars</th>
<th>from this school</th>
<th>total teaching income</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 up to 200</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>200 &quot;   &quot; 300</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>300 &quot;   &quot; 400</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>400 &quot;   &quot; 500</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>500 &quot;   &quot; 600</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>600 &quot;   &quot; 700</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>700 &quot;   &quot; 800</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>800 &quot;   &quot; 900</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>900 &quot;   &quot; 1,000</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1,000 &quot;   &quot; 1,100</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1,100 &quot;   &quot; 1,200</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1,200 &quot;   &quot; 1,300</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1,300 &quot;   &quot; 1,400</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1,400 &quot;   &quot; 1,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,500 &quot;   &quot; 1,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,600 &quot;   &quot; 1,700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,700 &quot;   &quot; 1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,800 &quot;   &quot; 1,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,900 &quot;   &quot; 2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,100 — 2,200</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mode</th>
<th>600–700 and 400–500</th>
<th>600–700</th>
</tr>
</thead>
<tbody>
<tr>
<td>median</td>
<td>612.50</td>
<td>625.00</td>
</tr>
<tr>
<td>answering</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>not answering this question</td>
<td>54</td>
<td>54</td>
</tr>
</tbody>
</table>

| total | 136 | 136 |
The inevitable result is that the teachers who have initiative and ambition will spend most of their time preparing themselves for better paid jobs, and will leave the middle schools as soon as they can make a change that will better their condition. Undoubtedly this is the main cause for the short terms of service and the rapidly changing teaching staffs which, we have already seen, are characteristic of teachers in the middle schools.

The meagerness of the prevailing salaries is not the only discouraging factor that tends to drive good teachers out of the middle schools. Even low as the salaries are they are not regularly paid. In every province visited, the teachers' salaries were reported to be at least two months in arrears, and in Peking seven months in arrears. The fact that the teachers stick to their jobs and work cheerfully and patiently under such a condition of injustice is more to their credit than to the credit of the higher officials who are responsible for this condition.

It is unfair to traffic on the necessities or the missionary spirit of the teachers; and it is disastrous to the schools. The inevitable tendency is for those who have ability and initiative to leave the schools after a short term of service and go elsewhere; so in time those who remain will consist only of the poorest and least alert,—those who cannot get other places that will afford them better livings,—with the addition of new recruits who are obtainable at low salaries because they are just starting as teachers and lack experience which is demanded for the higher and better paid positions.

Teachers' salaries should be sufficient not only for a living wage, but in addition for a margin sufficient to provide means for professional growth, such as books, advanced training, vocations, some travel, and the education of their children, as well as life insurance and savings for old age.
Salaries should increase with experience; but should be based on a scale of increases that also takes into consideration excellence of training, professional growth and activity, skill and success in getting pupils to learn, and loyalty and cooperation in operating the school.

The remedy—a scientific salary scale

There should be a regular classified salary scale based on these qualifications. Teachers should be advanced from class to class as their merit according to these criteria increases; and only teachers who continue to grow professionally, and increase their qualifications should be advanced to the higher salaried classes. Such a salary scale properly adjusted would enable the schools to retain the services of able teachers.

The heads of the schools should agitate for the establishment of a salary scale based on these principles; and they should insist before the government authorities and the public that school officials and teachers be paid promptly each month—not in notes or promises, as has frequently happened, but in real money. Thus only can earnest devotion and a high morale be secured and permanently maintained.

Closely connected with inadequate salaries and irregular payment thereof are two other prevailing practices that are destructive to teaching efficiency and ought to be discontinued. These are: (1) paying the teachers by the hour instead of by the year, and (2) permitting them to teach in more than one school. These practices tend to destroy the teachers’ morale, to weaken their loyalty to the school organization, to waste their time, and to reduce their teaching work to a perfunctory routine without originality, constructive-ness, or vitality.

That such must be the results should become evident from the following considerations:

1. A teacher should give all his time and thought to his own part in building up and perfecting the school
and especially his particular department of it, in improving the facilities for his teaching work, in planning his lessons and preparing to give them, and in cementing his contacts with students. It should be a part of every teacher’s duty to give guidance and friendly advice to his students concerning their studies and concerning the development of the larger life and character for national and social service. He should also spend some time in helping to build up and consolidate loyalty and school spirit among the student body.

2. He will not make any serious attempt to do this, nor indeed can he do it, if his time and effort be divided among two or more schools.

3. Part-time teachers lose an immense amount of time in traveling by ricksha through the narrow streets from one school to another; and this loss falls much more severely on the schools than on the individual teachers.

4. When a teacher is paid by the hour, he naturally feels that when he has taught through that hour, he has rendered all the service for which he is being paid. He is therefore likely to resent being called on to do anything whatever outside the classroom.

5. In consequence:

a. The teachers seldom make direct plans and preparation for their lessons before they give them.

b. They seldom personally prepare the apparatus for demonstration experiments, but usually leave that to the laboratory coolies so the students’ opportunities for seeing demonstration experiments are limited by the knowledge and skill of the coolie.

c. If apparatus gets out of order it is almost never repaired.

d. Students’ notebooks are not examined and evaluated; and test papers are not carefully evaluated.
When these important things are neglected, “part-time service” and “pay by the hour” may not always be the cause; but when teachers are employed and paid in this way they are almost certain to neglect such essential duties; and the main fault lies with the system rather than with the teacher.

The system of paying by the hour, and the general practice of employing part-time teachers should be abolished. It will be easier to do this if the enrollments of the schools are increased as recommended in Chapter 11. Also salaries should be paid promptly when due.
CHAPTER 13

METHODS OF TEACHING. MEMORY DRILLS
AND LECTURES

In a certain sense there are as many different methods
of teaching as there are teachers; and in that sense
teaching methods cannot be standardized. Yet most of
the practices used by different teachers have certain
essential resemblances, and so fall naturally into classes
that can be fairly well characterized by description. For
convenience of reference these may be named descrip-
tively as follows:

I. The Memoriter Recitation Method.
II. The Drill Method.
III. The Lecture Method.
IV. The Class Conference Method.
V. The Laboratory Method.

Within each of these classes of the methods there are
many variations; but in each case the variants may be
conveniently grouped into a few subclasses and given
names by which they may be characterized in discussing
them.

I. THE MEMORITER RECITATION METHOD

In its simplest and most primitive form this method
was common among all literate peoples during their
early development, and still survives to a very consider-
able extent among all peoples. It originated in the
East for teaching the books of the great sages and re-
ligious teachers. In using the primitive form of this
method, the teacher pronounced the words, and the pupils
repeated them after him until they had learned how to
pronounce the sounds, and had associated the sounds
with the written characters. The pupils then studied
by reading the lesson over and over, usually shouting
aloud at the tops of their voices, both in order that each
might hear himself, and that the teacher might know that
he was studying. When the pupils thought they had
learned the assignment they took turns, one at a time,
reciting it to the teacher from memory. In this way,
whole books were memorized, as well as short stories,
poems, and proverbs. This method was very effective
for this purpose; and it is doubtful if it has been much
improved upon. Its great fault, however, was that the
pupils were obliged to memorize without first under-
standing; and so the process was uninteresting, and
wasteful of time and effort. Yet for pure memorizing,
the method of requiring silent studying and then com-
pelling the whole class to listen while one pupil after
another recites, as is common in America, is both far
more wasteful and far less effective.

Modern experiments in psychology have established
certain principles concerning memorizing that ought to be
more generally put into practice. These are briefly
stated below for reference in connection with further
discussions of methods of teaching:

1. The matter to be memorized should be explained,
and its inner relations and connections of ideas fairly
well understood by the pupils, before they attempt
to memorize it. While learning it, the pupils should
attend as closely to the thought relations and correct
expression of them as to the mere words themselves.

2. While learning it, it should be
repeated as a whole instead of a small
part at a time.

3. The learner should apply himself
to the repetitions with the greatest possible zeal and
attention.

4. While making the repetitions, he should try to
recall as much as possible without looking on the book,
but should prompt himself by looking at the book for
the parts that he cannot readily recall.
5. The learning periods should not be so long as to cause losses of interest and energy from fatigue, and not so short as to provide insufficient repetitions.

6. At first the learning periods should be separated by short periods of rest or change of occupation.

7. The intervals between the learning periods should increase in length as the recalling becomes more nearly perfect.

8. Reviews should be made after longer intervals, but should be numerous enough to provide for the relearning of the forgotten parts before too much has been lost.

These principles of memorizing are now well known among psychologists and educators, and are taught in the Western normal schools; but unfortunately the proportion of teachers who make practical use of them is very small.

The primitive form of memorizer recitation method is still used to a considerable extent in the Chinese elementary schools; but in some of the best of these it is much improved by explanation before study, and by having the pupils tell some of the stories and poems in their own words, or dramatize them after they have learned them. This provides for motivation by making the learning a significant project.

Another form of memory method, which in the West is far more commonly used than it should be, is the catechetical method, or the memory-question-and-answer method. The teacher asks questions about facts only. These require only memory answers which are expected either to have been memorized word for word as in a catechism, or to have been memorized in substance so the pupil can give the substance in his own words. No thinking out of relations or consequences is required. The pupils are supposed to have memorized the required facts by individual study outside the classroom, and to be "prepared" to answer with the fact called for by any question the teacher may ask. He is
to do this when he is required by the teacher, who either
calls his name or gives him some sign either before or
after the question has been put. It is better practice
in almost all cases to put the question first, and then
designate the pupil who is to answer it. This tends to
make all the pupils try to recall the answer; so, theoreti-
cally, every pupil answers the question mentally before
it is answered aloud. Actually, many of them do not
do this, but take a chance that they will not be called
on, and remain mentally inactive. If the pupil called
on fails to give an answer that satisfies the teacher, the
teacher calls on another pupil, then another, and so on
until he gets an answer that satisfies him, when he passes
to another question. This is the procedure throughout
the recitation until all the questions have been answered
by one pupil or another. This catechetical type of
memory recitations is very inefficient; but it is better
than having no recitation work at all.
Memory questions are useful for three purposes:

1. In connection with the introductory or pre-
paratory step in a thought or problem lesson, to help
the students to recall facts that have been previously
learned and must be kept in mind in considering new
facts or principles or relations to be learned in the lesson.

2. To test the retention of previously learned facts
by means of the students’ oral responses.

3. To drill or practice the students in memorizing
new materials already explained and understood, but
not yet perfectly memorized. When questions are
asked for any of these three purposes, they should be
very clearly and concisely stated, and should follow
each other rapidly.

The teacher should not wait for delayed responses.
With a purely fact or memory question, the pupil either
knows the answer or he does not know it. There is no
occasion for reflective thinking. If he knows it, he can
give it immediately, and should always be required to do
so. If he cannot give it immediately he does not know
it; and giving him time and suggestions only tends to injure his mental habits. In this respect, a memory question differs fundamentally from a thought question which requires a little time for reflection and consideration before it can be answered intelligently. So when he asks a memory question the teacher should immediately name or signal the pupil who is to answer it. If the first one called on fails, another should be called on immediately, and if the second fails, another, and so on. Occasionally, but not too often, the teacher should call for volunteers. He may say, "Any one," or "Volunteers," or "Hands up," or simply raise his own hand. At this or some other suitable signal pre-arranged and understood, the pupils who know the answer will raise their hands. The teacher will then immediately indicate by name or signal the one whom he selects to answer the question. The pupils should be trained not to answer until called on or signaled individually, unless the teacher calls for a concert response.

In concert responses the pupils all give the answer at the same time, giving the syllables rather slowly, yet with the proper expression, so that all can speak together and every syllable will make a clear and distinct sound. Concert responses are more efficient than individual responses in cases where the response to be given by all the individuals is exactly the same. The reason is that when only one pupil is responding, all the others are more or less passive, while with concert responses all pupils are active all the time. An alert teacher can get around to different parts of the room during concert memory drills; and if certain pupils are not responding correctly or not responding at all, he can easily detect them, and give them some extra stimulation. This device is good for reviewing memorized poems, definitions, formulas, rules, or any other memory materials in which the wording or other factors of expression are fixed and definite. A good signal for a concert response
is to say the word "Class" or "All together," or make a gesture by extending the open hands forward and outward. This is to be done immediately after the question has been asked, not before.

Another type of memory recitation is called the **topical recitation**. It is much used in Western schools; but I have never seen it used in China. The teacher names a topic or subject representing a group of related facts that constitute a part of the assigned lesson. Such, for example, as the physical properties of oxygen, in chemistry; and the pupil who is called on responds by telling what he has learned about the subject matter indicated by the topic. Different pupils recite on the different topics. Sometimes the same topic is assigned to more than one pupil. The latter practice, however, tends towards wasteful repetition. If the student reciting on a topic misstates or omits an important fact, the teacher should call on another student to give it correctly.

It is possible to assign topics in such a way that the pupil must do a good deal of thinking in arranging the facts and working out their relations, and in getting information from various sciences outside the textbook. In this case the student’s response rises to the dignity of a report, and partakes of the nature of a problem or project; and the assignment must be given out some time before the report is to be made. When this practice is followed, it becomes more a thought method than a memory method, and is best used in connection with the class conference in which such a carefully prepared topic can be freely analyzed and critically discussed. Some of the very best teachers use a topical method of this thought-stimulating sort; but as used by the large majority of teachers the topical recitation is almost purely a memory exercise and therefore much less effective. In such subjects as history, geography, science, etc., the topical method even when the students respond only with facts and relations learned directly from the
textbook, is better than verbatim reproduction of the text. The student can be required to give the facts and relations in his own words instead of the words of the book; and this will at least require him to do some selecting and rearranging of the facts. A really skillful teacher, however, can always assign a topic in some way so as to make the discussion of it involve the solution of one or more questions of a problematic nature, so as to make the topical recitation a stimulus for thinking as well as remembering.

II. THE DRILL METHOD

This method is the proper one to use for class practice in the learning of motor skills, such as gymnastics, marching, and military drill, folk dancing, orchestra and chorus practice, writing, or any other activity consisting of either simple or complex movements that are to be associated with each other. Such, for example, are names and dates in history; names and locations in geography; words or phrases in the native language and corresponding words or phrases in a foreign language; number combinations and their sums, differences, products or quotients; things or acts and the words or phrases that represent them; names or statements of the laws of physics and the formulas that express them mathematically; or any other kinds of things that are to be associated with each other in pairs.

In using this method for practice in motor activities, the stimuli are given by the teacher in form of commands or signals, and the responses are made by the pupils simultaneously. The speed or tempo of the responses is regulated by the teacher as is done by the director of a chorus or orchestra, so that all may keep together. In gymnastic and typewriting practice, the tempo may be regulated by music from a piano or a phonograph. This is a device that is very
pleasing to young people, as it is well known to be in the case of marching or dancing.

In memorizing or reviewing or testing paired associates, it is common to use a formal question as the stimulus, and require a formal, grammatically correct answer as the response. Such procedure is good in conversational conference lessons where the purpose is to elicit thoughts and give practice in the grammatical and logical expression of thought; but it is entirely wasteful and out of place in a memory drill. The proper procedure in memorizing work is to present as the stimulus one of the pair to be associated, and to get the student to respond immediately with the other of the pair, with no extra words. This process is to be repeated with the next pair and so on through the list of paired associates.

The tempo should be regulated according to the promptness with which the students can respond — slow at first, and speeding up gradually, as the repetitions of the list increase the ability of the students to respond accurately and quickly.

As an example, let us suppose that the material to be associated consists of words or phrases in the native language, paired with their equivalent words or phrases in a foreign language. These may be arranged in two vertical columns, making a series of pairs on the blackboard, or on a chart, or on paper handslips (one for each student and one for the teacher). If the blackboard or a chart is used, one of the two vertical columns is to be covered by a strip of paper or cloth and the other, which contains the corresponding equivalents in the same order, is to be left exposed to view. The teacher will then say: “When I point to one of these words, give its equivalent in concert. Be careful to keep together.” The teacher then points to the words in succession and the pupils respond in concert. At first they go straight through the list, either upward or downward; then as the responses become quicker and surer,
the teacher skips around among the words, pointing out oftenest those least perfectly learned, and continuing until the pupils can respond promptly with the equivalent of every word. Then the column that was first covered should be exposed and the other covered; and the process should then be repeated. The words at first used as responses now become the stimuli, and _vice versa_.

In reviewing a list that has once been well learned, the teacher may say: "Give the equivalents of these words in order, beginning at the top (or bottom). Ready!—Begin!" Then the students will respond with the equivalents one after another in concert; and if they hesitate or miss on any, the teacher may have them go through the whole list again, either upward or downward, or he may point out and skip around among the words that have been imperfectly memorized, until the students again have the pairs perfectly associated.

The paper hand-slips may be used either for study before the drill, or for review drills. In the latter case they are to be folded along the vertical line between the two columns, so that when one list is exposed the other is hidden. Then when the teacher gives the directions and the signal to begin, the procedure is as before, except that the pupils look at the exposed columns on their hand-slips instead of looking at the blackboard or chart. If written responses are desired either for practice or for testing, a sheet of blank paper is placed alongside the list used as stimuli, and the corresponding words are written opposite them on the blank sheet. These may be exchanged and checked by the pupils, or they may be checked and graded as test sheets by the teacher. The simplest use of this type of drill is in oral or written spelling or pronunciation practice, when the word is pronounced by the teacher and spelled by the pupils either orally or in writing, or when the written or printed words are exposed as stimuli and the pupils respond vocally with the correct pronunciation of the words. In teaching spelling, written responses should be used because in daily life it is always the written word and never the oral spelling that is required.
In another variant of the memory drill that is widely and successfully used in America, "flash cards" are used. A flash card has one member of an associated pair printed on one side and the other member on the other side. When the teacher holds up the card with one side toward the class, the students are to respond with the equivalent, which they do not see because it is on the other side. The cards may be assorted in sets each of the proper number for a lesson. For reviews the teacher may select out from several sets only those cards representing pairs that the pupils have not yet got perfectly associated.

Memory drills in science may be used with very good effect, and will be very interesting and profitable to the students if ingeniously conducted. A series of objects may be exposed as stimuli, and the class required to answer by naming each one, or by giving some designated specific quality. Thus a series of birds or good pictures of the birds may be shown, and the pupils required to respond with their common names. Then the same bird may be shown again as stimuli and their scientific names required as responses. Other sets of responses may be such data for each as the family or order to which it belongs, its principal food, the kind of place where it builds its nest, and so on. Similar drills may be arranged for memorizing the essential data concerning plants, insects, and other living forms. Similarly, in connection with the studies of minerals, memory associations may easily and quickly be established and fixed between the objects and their names, the objects and the elements of which they are composed, or between their names and their colors, hardnsses, specific gravities, or crystalline forms, uses, or the localities where they are most commonly found, and so on.

So with chemical substances (when they can readily be recognized by their visible properties), or with their names (when the substance cannot be so recognized) the chemistry teacher can make paired lists or flash cards;
and use the memory drill methods, to establish associations between substances and names, and between the substances or their names and their physical states, colors, symbols, atomic weights; or any other such data as it may be worth while to spend a little time in permanently and correctly memorizing. In the study of the sciences, and of history languages, and other subjects also, some organized movements, skills, or facts must always be learned because these are essential to the mastery of their theory or practice. Therefore, science teachers as well as others should use efficient memory drills instead of the wasteful and uninteresting memory methods that are commonly employed. It will be easy for them to devise efficient methods if they will but keep in mind the examples that have just been given.

The psychological laws of association that underlie correct methods of memorizing and acquiring motor skill may be summarized in the following statement:

The likelihood that a given response will follow a given stimulus is in proportion to the frequency, recency, vividness, and resultant satisfaction with which it has been previously connected with that stimulus. It also depends on the attitude or total frame of mind of the individual towards the situation when he receives the stimulus.

This principle, then, tells us that at the beginning of a practice period we must try to get the students into a favorable, pleasantly expectant, and alert frame of mind, so they shall apply themselves with zeal and concentration of attention. We must try in every possible way also to make the presentation vivid and interesting. One way is for the teacher himself to be alert and interested in the drill, and thus be in a contagiously pleasurable state of mind. Frequency is secured by many and rapid repetitions and recency by reviewing or practice periods at suitable intervals best determined experimentally by occasional test drills. At least one or two review drills should be held each
month, and a series at the end of each term, covering that part of the essential memory material or skill that is most likely to be forgotten.

If such correct psychological methods are used in memorizing, both time and energy will be saved rather than lost by having a considerable amount of such data memorized. Thus more time, not less, can be devoted to training in thinking. All the time which is now lost by the inefficient memory methods ordinarily used can be saved and devoted to practicing the students on thought questions, problems, or projects. Also the practice that is given in thinking will be more effective because students can think out problems and problematic questions more quickly and easily when they can readily recall the facts that are essentially related to the question or problem.

Furthermore, and finally, the teacher should know the fact that responses that are themselves satisfying or are directly associated with satisfaction tend to persist, while responses that are themselves annoying or are closely associated with dissatisfaction tend to be discontinued and forgotten. The first important thing for the teacher, then, is to get the students strongly motivated, so they will try hard to make the right response, and keep them trying until they succeed. Then he should commend or encourage them, so the right response shall be rewarded with satisfaction. If the response is difficult, as the pronunciation of a strange foreign word, or the making of a complicated series of movements, as in tying certain kinds of knots, he should help the pupils by explaining the principles, and by giving the response himself and getting them to imitate him. Thus with his assistance the pupils must get the right start and feel genuine satisfaction in it. Then practice with zeal and attention will perfect the skill or fix the memory connection.

III. THE LECTURE METHOD

There are two types of lectures, the formal and the informal. In the formal lecture, the teacher does all
the talking and all the demonstrating. The students are supposed to listen, to follow the lecturer’s arguments and the facts which he adduces in evidence, and to take notes of his main points and the supporting facts, for study and reference. Some lecturers allow themselves to be interrupted occasionally by questions, and even encourage them. Others call for questions or discussion at the end of the lecture. Both these customs represent good practice. The former is usually the better; because it enables the lecturer to find out whether the students are following him with active minds, or even anticipating his line of thought, which is still better.

Many lecturers, however, do not encourage questions at all. This is bad practice; because it tends to increase the natural tendency of the students to be in a passive instead of in an active state of mind during the lecture, while the real purpose of the lecture, or in fact of every other method of teaching is to stimulate and direct self-activity.

The formal lecture should be used but rarely, especially with younger students; but occasionally it is useful, if very well done. Some teachers do it so well, and in such a suggestive and inspiring manner that they are justified in using it often: but such talented lecturers are relatively very few.

In the informal lecture, there is more of active mental contact between teacher and pupils. The teacher encourages questions and comments from the students during the progress of the lecture; and he often asks questions as he proceeds. He also invites one or more students to help him with the experiments and demonstrations. In these ways he makes the students feel some responsibility for personal participation, and keeps them interested and active. Occasionally when marshaling evidence leading up to a conclusion, or to a question that must be decided by the weight of the evidence for or against it, he stops and gives the class
opportunity to consider and argue it out, instead of giving them his own conclusions ready-made.

Conducted in such a way, the informal lecture stands midway between the formal lecture and the class conference, and may be a very effective method of teaching, especially for certain kinds of occasions.

The lecture method is useful for three kinds of purposes:

1. When presented vividly, clearly, logically, and with striking and convincing experiments, demonstrations, charts, models, pictures, lantern slides, or specimens it is very useful for arousing interest in some new phase of the subject. If successful, it serves to stimulate the curiosity of the students, and incite them to study and investigate the new topic for themselves. It is good, therefore, to use in introducing the students to a new part of the subject which they are about to take up for study. Giving them some idea of what is coming under the new topic, of the use and significance of what they are about to study, and of the relations of the new topic to those previously studied, helps to create a desire to know more about it. In short, if successful, the lecture is good occasionally for motivation and inspiration.

2. It is useful to fill in the logical development, when the subject is taught largely through individual laboratory experiments, especially when the time is short or the textbook inadequate, so that this cannot well be done by the class-conference method.

3. Finally the lecture method is useful in presenting some new subject matter or method that is not included in the regular laboratory experiments or in the textbook or available reference books, but which the teacher has learned through his own study and research, and which, therefore, cannot be presented in any other way.

The lecture method is a timesaver when it is effective; but if used too often it is not effective. It is educative to
the individual pupil, only when he is alert and attentive while it is going on. If he does not merely follow the teacher’s thoughts but thinks with the teacher and anticipates his arguments and conclusions, he gets some real practice in thinking. However, only the brighter pupils, and those who are most interested in the subject, can do this. Moreover, only the most talented and practiced teachers can present ideas in such a suggestive and stimulating manner that the students will think with them and anticipate their conclusions.

Here are some of the principles that underlie successful lecturing:

1. The lecturer himself must have a pleasing and attractive personality and manner, and a pleasant, well-modulated voice.

2. He must speak distinctly and with just sufficient loudness to make sure that every one in his audience shall hear every word that he says.

3. His diction must be smooth and easy, but also forceful, especially when bringing out the most important facts and relations. He should take particular care also to make his language clear and concise.

4. He should present clearly, suggestively, and in a logical order, the evidence in support of his conclusions, and should also make a fair presentation of the evidence against them. He should present clearly the opposing arguments and meet them by fair rebuttal.

He will thus place his hearers in the position of a jury, and allow them to reach their own conclusions on the basis of a fair consideration of the evidence, instead of taking their opinions from him ready-made and at secondhand. In this way they will learn by practice to make intelligent judgments as well as to absorb information. Information passively absorbed can seldom be readily recalled for active use; but information gained in the process of thinking and judging is actively sought because it is needed in reaching a satisfying conclusion. Hence information so gained
in an active state of mind is longer remembered and more easily recalled when wanted.

5. The lecturer should make liberal use of all kinds of visual aids, such as diagrams, pictures, experiments, and prepared specimens. He should have these arranged on the lecture table or on suitable display racks, so that they can be shown in the proper order, one after another, without any loss of time in finding or arranging them. They should be shown in such a way as to make certain that every individual in the audience shall see clearly every object that is shown.

6. At the end of the lecture the main points should be briefly and clearly summarized and their significant connections with what previously has been learned should be made clear. If these points have some direct connection with future lessons, it is well also for the teacher to give some indication of such connections and their practical significance, as a means of arousing interest in the coming lessons. A demonstration experiment should be carried out to a logical and convincing conclusion, and should be so used that its place as a part of the evidence in support of a definite law or principle is clearly apprehended by the students.

7. To apply successfully all these principles of lecturing, it is necessary for the teacher to plan out his lecture carefully, and to prepare and arrange his demonstration devices beforehand. He must practice and rehearse his demonstrations and experiments before the lecture, so as to be sure that they shall not fail. If his experiments fail, the students lose confidence in the teacher, and they also become cynical concerning experimental evidence and logical proof.

8. Finally, the lecturer himself must be interested and enthusiastic about the subject on which he is lecturing.

One of the greatest faults of the lecture method is that it is used too frequently. This is the case in American colleges where there is far too much dependence on lecturing, especially in teaching the less advanced classes.
Fortunately the custom of lecturing too much is not so common in American middle schools. Experienced teachers learn to avoid this fault. It is most common among teachers who are just out of college and especially young among those who have not had good teacher-training courses and practice teaching under expert supervision. In China, everywhere, the lecture method is used almost exclusively by nearly all the teachers. Those who do not use it too much are very rare exceptions. In general, it should be used only on rare occasions in the elementary schools, and not more than five or ten per cent of the time in the middle schools.

The almost exclusive use of the lecture method originated in Europe, and especially in Germany, where the teachers are highly trained in the use of it and mostly do it very well. This method has filtered into China through the Japanese schools, which adopted largely the German methods; and the filtered product in China is, in general, not comparable in excellence with the performance of the highly trained German teachers.

The methods of the teacher should be such that the students shall respond to his acts by thinking and investigating for themselves, and applying their conclusions to gain some new knowledge or to bring about some practical result or to construct some practical device.

Thus only does the student become competent to do things through practice in thinking and practice in doing.
CHAPTER 14

METHODS: CLASS CONFERENCE AND LABORATORY

1. DEVELOPING INITIATIVE AND THINKING ABILITY

In general, the teacher who should be regarded as most successful is he who contrives to make the students do most of the thinking, talking, and experimenting for themselves. The more nearly he can make himself unnecessary to his pupils the more really successful he is; because he has been able to train them to think and discuss, and to work and experiment independently.

Initiative, ingenuity, resourcefulness, and self-control are the traits that we wish to develop; and these traits grow and strengthen by being exercised.

Students should not be told or shown anything that they can be made to find out for themselves without too much discouraging difficulty, and without too much loss of time. The function of the teacher is to arouse and direct the self-activity of the pupils, and help them over the difficulties that they cannot surmount without some assistance. For this purpose, the class-conference method, when used in connection with the laboratory method, is the most effective. It has grown by a slow process of evolution out of the question-and-answer methods previously described, and has been brought by many teachers to a high state of efficiency; because they realized the necessity of making the students think for themselves instead of always memorizing the thoughts of others, and repeating them like parrots.
In the conference lesson, the main purpose is to get the students to deal with the subject matter logically—to think through it themselves. They are expected to recall facts and relations that they have previously learned, and reason from these known data to the conclusions that may be logically drawn from them. Memory, then, is an important factor; but it is not the main purpose. The main purpose is to have the students learn relations or laws or principles that are new to them and to learn them by thinking them out. Thus they may get practice in thinking; and their ability to deal with ideas and relations will grow.

II. How to Make Students Think

To make any one think, you must confront him with a problematic situation. To understand this, give him a puzzle, or show him a sleight-of-hand trick. If his mind is not already occupied with some problems that are more important to him, he will immediately begin to manipulate the puzzle and try to solve it; or in the case of the trick he will begin to wonder how it is done and will try to think it out.

If you put a question to a person who at some previous time has known its answer, he will not try to reason it out. He will only try to recall the answer from memory. Therefore, it will not be a thought question to him. It may be problematic to others, but to him it is purely a memory question, and can only become a problem in case he fails to remember the answer.

This psychological fact is not apprehended by many teachers of geometry, who waste nearly all the time in their classrooms in having their pupils recite from memory the so-called "regular propositions" instead of spending it on the discussion of the so-called "exercises," which are theorems and problems whose solutions are not worked out in the book and which the pupils, if they get them, must reason out for themselves. Such teachers see
to believe that geometry is a great subject for teaching young people to think; and so indeed it is, but not as they are accustomed to use it. When the lesson consists exclusively in reciting propositions whose solutions are printed out in the book, it is purely a memory exercise. In this case the only pupils who are given any opportunity to think are those who have come into the classroom without having made previous preparation, and are unexpectedly called on to recite. To them the proposition is full of thought questions. It is a problem, and if they can solve it they should be commended, instead of being reproved, for coming in without having memorized the lesson! The prevailing method of teaching geometry in China is even less efficient than the worst of those used in America; because in China it is usual for the teacher to recite and explain all the propositions himself while the students merely sit. At best, they may listen and do a little thinking by anticipating what the teacher may say. At the worst, they look out of the windows or take a little nap. With such methods prevailing it is no wonder that one or two years of each student’s life must be wasted in preparatory or subfreshman classes after he graduates from middle school and before he can enter college proper.

III. How We React to a Problematic Situation — An Illustration

To use the class-conference method effectively one must first have a clear apprehension of the thinking process, as well as of the conditions that make thinking possible. Just here a simple example may be helpful:

Let us suppose that a tourist sets out on an unknown road, which he has been told leads to a certain little town at the base of a range of low mountains, where there is an interesting temple and a pagoda. He wishes to visit the temple, but has been unable to get detailed information about the route. After proceeding for some distance he comes to

Reflection and analysis.
a place where the road forks or divides into two branches; and he does not know which branch to take. He is face to face with a problematic situation. Being interested in reaching his destination, he begins to reflect — that is, to recall the facts that are associated in his mind with the situation. The town, he remembers, is on high ground near a range of mountains; but no mountains are in sight. He walks a little way down the left fork of the road, and observes that it leads out into a plain. Then he tries the other, and observes that it, too, is nearly level, but seems to rise gently, and leads along the bank of a stream. Going farther along this fork of the road he finds that it leads upstream, and that the stream has a rapid current. From this newly discovered fact he reasons that the stream must come from hills or mountains which, although he does see them from the low ground, cannot be very distant; because he remembers that swift streams always come from steep slopes not far away. So probably the town he is seeking is to be reached by traveling the right fork of the road, not the left.

He therefore adopts this inference as a hypothesis or tentative conclusion, and proceeds to test it out by continuing along the right-hand fork of the road. He now recalls that the distance of the town from the place where he started was said to be not more than a day’s journey; and as the day is well advanced, he infers that the remainder of the distance must be rather short. Consequently he reasons that by climbing the small hill, he may be able to see the town.

Arriving at the top of the hill, and looking in the direction of the road and stream he sees in the distance a low range of mountains, and at the base a small town. Remembering about the temple and pagoda he looks for them in the valleys higher up the mountains and in one of these nearest the town he is able first to pick out a pagoda, and then some temple roofs among the trees in the valley. The facts just observed correspond with the description
of the place, as it had been given to him, and therefore confirm his hypothesis that the right-hand fork of the road leads to his destination. So he accepts this hypothesis as his conclusion, and considers the problem solved. He is satisfied, and continues on the road that he had tentatively chosen. He cannot be absolutely certain that his conclusion is correct until he reaches the town and confirms it by inquiry there; but he is sure enough to act on it as the best course of procedure, and dismiss his doubts. Most of the conclusions that we act on in daily life are of this nature.

In science, when a working hypothesis is supported by a great weight of evidence, but is still subject to doubt and dispute, it is called a *theory*. When it has been compared with all the known facts that are related to it, and found to be in agreement with them, and when every apparent negative instance or contradictory fact has been acceptably explained or shown to be really in agreement with it, the theory becomes a fact or a demonstrated law, or a principle.

IV. **Analysis of a Complete Act of Thought**

What Dr. John Dewey calls a complete act of thought is fairly exemplified by the foregoing illustration. It has the following elements or characteristics:

1. As a necessary condition of thinking the person must be confronted with a problematic or forked road situation, involving a doubt or difficulty which cannot be overcome by any habitual movement or act of memory.

2. After the first shock of surprise has passed, the person, if he is mentally quick and active, begins to *reflect*. In this process he recalls, one after another, facts that have been previously learned, and that are mentally associated with some features of the problematic situation.
3. He selects and considers those ideas which are found to have a bearing on the problem and give some promise of helping him to solve it.

4. He reasons out their implications or probable consequences, rejects those ideas whose consequences are not in accordance with the observed facts, and selects the most promising idea as a working hypothesis to be tested.

In this testing of the hypothesis he may have to make special observations or to experiment in order to ascertain more facts.

5. If the selected hypothesis is found to be contrary to fact it must be rejected, and another idea must be selected and tried out; but if on the contrary it corresponds with all the fact, it is adopted as the conclusion, or solution of the problem.

A debate is a familiar and interesting method of solving a problem, by choosing between two conclusions, one of which is the opposite of the other. The choice is made in favor of the affirmative or the negative conclusion according to which has the greater amount and weight of evidence in its favor and the lesser amount and weight of evidence against it.

Since the class-conference method is very rarely practiced in China, and most of the teachers in the middle schools are entirely unfamiliar with it, the foregoing descriptions of a problematic situation and of the thinking process have been thought necessary as a preliminary. With these ideas in mind it is hoped that the teachers may get from the following description a good idea of how to conduct a conference lesson.

V. HOW TO CONDUCT A CLASS-CONFERENCE LESSON

Such a lesson must be carefully planned beforehand. Since its principal aim is to give the students practice in thinking, and to get them to learn new principles by thinking them out, it must provide problematic situations
Plan the lesson beforehand. To make them think. The subject matter, instead of being presented in the order of the textbook, must be rearranged and organized about the chosen problem or problems as centers. Hence the problems must be such as come under the general topic or division of the subject matter to be taken up in the lesson; and they must involve as their conclusions the new laws or principles, or their practical applications, that the teacher is planning to have the students learn in the lesson.

The known conditions from which the students are to reason out the conclusions,—that is, the known conditions from which the problems are to start—must be mainly facts which the students have previously learned and may therefore be expected to recall. They may, however, consist partly of facts which the teacher must supply, because the pupils may not yet have learned them.

For the students, then, the problematic questions will relate the new with the old, because they will learn the new from the old by reasoning from the known to the unknown.

The intermediate ideas, suggestions, and hypotheses by means of which the students are to reason from the conditions to the conclusions also will be mainly those which they themselves will be able to recall from memory when they begin to reflect on the problem; but it will be necessary for the teacher to supply some suggestions and ideas occasionally, to help the students along. In the class-conference lesson the pupils and teacher solve the lesson problems and carry on the discussion cooperatively. The pupils face new and problematic situations, which all should participate in discussing and solving. They go mentally where the discussion leads them, recalling familiar facts and discovering or learning new facts and new relations. The teacher, however, has planned how the discussion shall go, and is there to direct it and see
that it does not get off the main track along which he
has planned to have it go.

He must therefore know well the main characteristics
of the five (or sometimes six) steps in the solution of a
problem in a class conference. These are
named and described below:

1. *Preparation for the Problem.* In this step the
teacher arranges the problematic situation by setting
out the conditions of the problem clearly. In order
to do this he helps the students to recall from their
own experiences or their previous lessons as many as
they can remember of the facts that are necessary for
getting a statement of the problem. This is done by
rapid-fire questions and suggestions. Next he supplies
for them such additional facts as are needed. He may
do this by simple telling, or better, when it is possible,
by presenting an experiment, or showing some specimen,
picture, diagram, or other demonstration material.

2. *Statement of the Problem.* The teacher now tries
to make the students apprehend the problematic
situation, analyze out its essential problematic elements,
and get a clear and concise statement of the conditions,
so as to attack it intelligently. In doing this, he uses
questions and suggestions—or tells them directly,
but only after he has given them the opportunity to
do for themselves what they can do promptly and
without loss of time.

3. *The Attack on the Problem.* This is the stage
of reflection—the recall of suggestions, ideas, and
facts associated with the problem or similar problems
previously solved. In this stage the suggested ideas
are to be quickly considered with reference to their
promise of helping in the solution; and those which
are irrelevant or unpromising are discarded, while the
relevant and promising ones are retained for further
examination. This stage is like a preliminary elimina-
tion contest for a debate or a tennis tournament.
The ideas are selected for the final contest by first
eliminating the unfit.
4. Selecting a Hypothesis. The promising suggestions are now tested by developing or reasoning out their implications or probable consequences, and comparing these with the facts. In this stage, the suggestion that accords best with the facts is selected as a working hypothesis.

5. Testing Out the Hypothesis. The hypothesis is now subjected to more rigorous testing, in consequence of which either it will be accepted in its original or a modified form as the conclusion or solution, or will be rejected in favor of the next promising suggestion, which would then be examined and tested in a similar way. In this stage every implication or probable consequence of the hypothesis is reasoned out and compared with the actual facts. These facts may be all known and can be recalled or found by reference to authoritative books, tables, or records, or they may be found out by direct experiment or observation. In this part of the conference lesson the teacher helps only when necessary, and throws the responsibility as much as possible on the students. His function is to stimulate the pupils and so direct them that they will speak only one at a time, observing courtesy and efficiency in discussion. He helps them to keep the problem clearly in mind so they shall not introduce irrelevant ideas or unnecessary repetition, or otherwise waste words or time. He will do this by concise suggestions or questions, by designating which student is to speak when several desire to talk at the same time, by calling on students who are not participating, to get them into the discussion, by redirecting the discussion if the students get to talking off the point or otherwise illogically. He should not hesitate to tell or suggest a fact or relation when necessary, but should talk only rarely when telling or questioning or suggesting is needed. A very important part of his work is to place the necessary facts within the reach of the pupils when they are not such as can be
recalled from memory. These are such facts as must be found in books or reference tables, or in maps, charts, specimens, or pictures, or in demonstration experiments. In all such cases the teacher must present the facts so all pupils can hear or see them at once. In such demonstrations some of the pupils may assist; but if so they should be required to rehearse their parts beforehand if this is necessary in order that they shall do them quickly and successfully.

6. Conclusion and Verification. Acceptance and formal statement of the conclusion is usually the final step; but often, and very properly, another step is added. This is verifying the conclusion by further appeal to facts and experiments, or by making some application of the principle in the field of practical activity. This verification or application may have been sufficiently done in the process of testing out the hypothesis, or it may be reserved for the laboratory or for later advance or review lessons. In general it is justified by the principle that as soon as possible after the new knowledge has been gained by the students, it should be utilized by them for some significant purpose. This helps them to appreciate its value more and to remember it better.

VI. Problem Solving and the Organization of Knowledge

The foregoing steps of problem solving as outlined indicate the general method by which the ordinary problems of life activity, both large and small, are solved. The "scientific method" of research or problem solving is the same, excepting that the thinking is more systematic and the testing more precise, detailed, and exhaustive.

Usually in the class conference, as in daily life, the distinction between the different steps will be far less marked than it is in the description. The different parts of the process may overlap each other to a certain extent;
and also certain facts and implications may be so obviously true that at times no conscious reasoning or selecting out or testing is necessary. The simpler the problem the more likely is this to be true.

The lesson may consist of only one big problem or a part of a big problem the remaining parts of which are solved in other lessons. It may consist of two or three smaller problems, each requiring relatively small amounts of selecting and testing, so that all can be finished in one class period. Finally, it may consist of twenty or more shorter problems, or problematic questions, which are very closely related to one another as well as to the main lesson topic or its principal subtopics. In planning and carrying out the lesson, skill and judgment must be used by the teacher in so relating the problems to the subject matter, that the development and organization of the subject matter shall be consecutive. In the lessons it must be organized around the lesson problems, which must be so chosen that this can be done. Later, in the review lessons, the learned subject matter should be reorganized with reference to the main principles of the science, so that thereafter it will be available for later reviews and permanent reference. For this final purpose the customary arrangement under topics and subtopics is better.

Skill and judgment in the use of the class conference and problem methods can be acquired by any intelligent teacher through practice in using them. Let teachers only try them out persistently, and they will find the interest, responsiveness, and achievement of their pupils so much better that they will never again be content to continue with the ineffective methods that are so commonly used.

VII. THE LABORATORY METHOD

The foundation of all scientific knowledge is observation and experiment. Observing and experimenting constitute a large part of the work of every scientist. Therefore
if we wish to train scientific workers, or to train people who will understand, appreciate, and support scientific work done by specialists, we must give them, while they are students, some opportunities to observe and experiment. It is not sufficient for them to see others experiment and observe. That is worth much, but really to understand science, one must actually make experiments himself. The laboratory method of teaching has grown up in modern schools in response to this need. Excepting in some colleges and universities instruction through this method is rare in China. Only a very few of the middle and normal schools, and some of the technical and agricultural schools use it to any considerable extent, and still fewer do it adequately or thoroughly. Therefore one of the most important steps needed for the improvement of science teaching in China is to make the laboratory teaching more thorough and adequate where it does exist, and to introduce thorough and exacting laboratory methods in all middle and higher schools where it does not exist.

It is possible for almost every teacher of science in China to introduce into his courses some individual laboratory practice by the students if only he has the determination to do so. Even a very few experiments, made with the simplest apparatus, will be exceedingly valuable in scientific instruction if they are thoroughly, accurately, and thoughtfully carried out.

VIII. THE CHOICE OF LABORATORY EXPERIMENTS — CRITERIA

In introducing such work the teacher’s first problem is the choice of experiments, which should be made in accordance with the following guiding principles:

1. The laboratory lesson should be such as will provide the student with the means of finding out, by observing and experimenting, the answer to some question that constitutes an essential step in the
solution of some problem or problematic situation that is significant to him.

2. It should have some direct and clear connection with what precedes and follows it in the course.

3. It should be a means of compelling careful observation, discrimination, and reflection, and should afford some opportunity for the development of skill and self-reliance in "putting questions up to nature," and getting the answers by observing.

4. It should be fairly simple. If there are too many things to observe and interpret, the students may get confused and discouraged.

5. It should not be too difficult of manipulation. Any student who is fit to be in the course should be able to complete it with fair success and reasonable speed. It should not be too easy, else it will fail to interest the students, and they will not take it seriously.

6. It must be capable of being done by the students with a respectable degree of accuracy; and such accuracy must be insisted on, else the students will have no faith in it nor in what it is intended to teach.

7. It is desirable that the results of the experiment be such as can be checked by comparison with each other rather than by comparison with a result in a textbook or laboratory manual. This makes the students rely on their own observations instead of upon the authority of others.

8. The reasoning connected with the experiment should be simple enough so the student can do it himself with little or no assistance. In order to learn how to reason, he must have practice in reasoning on questions which he can reason out successfully by himself.

9. Either it should be short enough so it can be properly finished in the laboratory period, or it must be capable of being divided into two parts, each of which can be done in a laboratory period.

10. It must be such that it can be carried out with materials and apparatus that are possessed by
the school, or that can be easily obtained before they are needed.

Many laboratory manuals and textbooks contain lists of such experiments, with directions for carrying them out, and lists of the needed materials and apparatus. From these the teacher may make a selection of those which fit in with his course and with the equipment that he has, or that he can obtain by purchase in the local shops, or have made by local artisans. If he will investigate in the local shops he will be surprised to find how many materials and devices for good laboratory experiments can be purchased or made at small cost.

IX. HOW TO INTRODUCE AND CARRY ON THE LABORATORY METHOD

A minimum of one double period a week ought to be devoted to laboratory lessons in each science that is taught; but if enough equipment is not available and cannot be obtained, the teacher at least should have as many suitable experiments made as he can provide equipment for. Most of the schools have a very considerable amount of apparatus for demonstration experiments to be made before the class in the classroom, and among this can be found enough for at least a few experiments to be made individually by the students. If only five or ten suitable laboratory experiments can be provided for, these, at least should be made.

The next problem for the teacher is to provide a suitable place where the students may work at the experiments. Most of the middle schools have no special laboratory rooms at all, and only one or two classrooms for all the science work. Most of them have one stock room (a few have two), in which the equipment for classroom demonstration in all the sciences is kept; and usually these are too small.

A satisfactory suite of rooms for teaching one science consists of a laboratory room approximately 24 feet
A place where students can work.

wide by 32 feet long, a classroom $24 \times 32$ feet, and a stock room of half this size, or $24 \times 16$, between the classroom and the laboratory. However, even if it be impossible to get a special room for the laboratory it is yet feasible to carry on some laboratory work in the classroom. Some plain, strong, wooden tables can be put in the rear portion of the room; and stout shelves or wall tables 18 or 20 inches wide can be built along the wall next the windows. Space can be economized by replacing the school desks by tablet chairs. Thus a classroom of the size prevailing in the Chinese schools may be very cheaply converted into a combined classroom and laboratory.

The minimum working space for one student is $3 \times 1\frac{1}{2}$ feet; so four students can work at one table 6 feet long and 3 feet wide. The minimum space between the sides of two tables is 4 feet.

Supposing that suitable experiments have been chosen, that the necessary materials and apparatus for them have been provided, and that there are suitable tables where the students can experiment, then the method of conducting a laboratory lesson is quite simple.

The apparatus and materials for each student's experiment must be placed on the table where he is to work. He must have, either in a printed laboratory manual or in the form of printed or mimeographed sheets, the directions which tell him what to do, what kind of results to look for, and how to record the observed data and conclusions when he gets them.

As soon as the students come into the room they begin immediately to carry out their experiments in accordance with the directions with which they have been provided, unless the teacher desires first to give them some additional directions. They work straight on through the laboratory period, experimenting, observing, recording data, working out the numerical calculations if there are such to be made, drawing inferences, reasoning to
conclusions, and writing these down in their laboratory notebooks in proper form, according to the general directions. In the meantime, the teacher supervises them. He goes from one to another, giving as much individual assistance and instruction as may be necessary to help them over their difficulties, but no more. He watches their procedure and their notes, so he will know when they need help. He is careful to insist that everything be done with accuracy, neatness, and thoroughness, and tries to teach them to work methodically, and always with minds thoughtful and alert. Occasionally he tells them just what to do or does it himself to show them how; but more often he asks a suggestive question which will make them think it out for themselves. In this way he tries to train them to experiment and think for themselves, so that by practice they will gradually become more and more resourceful and independent.

When the end of the period is near, the teacher directs the students to stop work and put their apparatus in order, or put it back in cases or drawers where it belongs.

It is easier to manage laboratory instruction if all the students work on the same experiment at one time; but this requires a set of apparatus for each pupil for each experiment. The number of required sets may be reduced to one half if two students work together with one set, or to one fourth if four pupils work together. It may be further reduced to one eighth if two different experiments are carried on at the same time, one by one half the groups and the other by the remaining half of the groups. By having three or four experiments going simultaneously, the number of required sets can be further reduced to one twelfth or one sixteenth. Such a grouping and sectioning of the students is justified if only a minimum of apparatus can be provided; but in general the efficiency of the instruction and the learning will be less in proportion to the number of different experiments that are going on, and also in

How to manage with little apparatus.
proportion to the number of pupils in a group. But even so, if the teacher is efficient and resourceful enough to manage it fairly well, it is much better than having no laboratory practice at all. Therefore the teachers should introduce and carry on laboratory work in this way until they can find means to build up their equipments to a more efficient standard.

Much of the value of laboratory practice is dependent on the making of adequate notes, neatly and methodically arranged. Therefore the teacher should examine and criticize the students’ notebooks frequently, and make them do over again any work that is not satisfactory. The teacher can save himself much time and trouble, and largely prevent the students from copying each other’s notes, if he will keep a close watch on their notes while they are working in the laboratory, and check the most important results before they leave the room.

An alert teacher can handle a section of twenty-four students in the laboratory at one time. If there are more, he ought to divide the class into two sections or have an assistant. A section of sixteen to twenty is much easier to handle and requires a proportionally less amount of apparatus.

Ordinarily a single class period is too short for a laboratory lesson; and if possible two consecutive periods should be given to each laboratory exercise. The time schedule should be so arranged as to provide for this.

The amount of laboratory work to be done in each subject should, in general, be such as can be well and thoroughly done in one double period a week during the school year or from thirty to thirty-five exercises.

The laboratory and the classroom lessons should be closely related. Time should be provided in the classroom lessons to discuss the main points of the laboratory work thoroughly. So the pupils may understand the procedure and the theory
of it, how it is related to the principles learned in the classroom, and what its significance is in connection with the practical use of the science in everyday life situations.

X. PROJECTS AND THEIR FUNCTION IN TEACHING

A project is an undertaking, chosen or accepted by the student because it has value or significance to him for its own sake, as distinguished from a formal school task that is undertaken because the teacher requires it. The student’s plan or undertaking becomes a finished project when it has been carried to completion in its natural setting. Most school tasks or undertakings are carried out in an artificial setting more or less foreign to the student’s aims, purposes, and desires in his life outside the school. This to a large extent is inevitable; but the project idea grows out of attempts to organize the things that have to be learned in school in such a manner that they can be linked up with the purposes and activities of the student’s normal daily life in the world outside the school—the world in which he is to work and live and be an active social unit. The wise teacher, then, tries to find projects which the students can carry out in their natural setting, to meet ends or purposes of their own, and which at the same time require for their accomplishment the very knowledges and skills that the school is expected to teach them.

A simple illustration will make this clear. The teacher of physics wants his students to gain a lot of knowledge about electricity and how to handle practical electrical devices, and about the uses of electricity in the economic life of the people. He can teach this in a formal way, and even if he uses the best methods that have been described in this chapter, he cannot expect to be always successful; because at many points the students will lack a compelling inner motive for getting and retaining the information and skills that he wishes them to acquire.
But supposing that a group of pupils form an intense desire to build, install, and operate a wireless telegraph and telephone apparatus, so that they can receive messages that are coming in from the big sending stations and also exchange messages with a school in another city. Then for them the whole situation is changed. The problem is in its natural setting. It is tied up with the desires and ambitions of the students in the outside world. The school physics class and laboratory become the obvious means to the boys of getting a great body of information and skill which is indispensable to them in carrying their project to completion. Now with the accomplishment of the project as their objective, they will be hungry and thirsty for the information that the teacher wants them to get. Now they want it for their own purposes. Instead of attacking it half-heartedly merely because it is in the course and required of them by the teacher, they attack it largely because it is demanded for the satisfaction of their own inner desires. The teacher is now their friend and valued helper instead of being an unwelcome taskmaster.

What they learn because they need it to complete a real attractive project will be better remembered because it is learned in connection with vivid experiences, and with interest and attention at white heat, and also because it is frequently used while they are in a similar favorable frame of mind. Finally, the attitude of mind towards what is to be learned about the subject in general becomes more favorable because its connection with the pet project has come to be appreciated. The one electrical project may thus serve to motivate them strongly for study of the whole subject of electricity and its applications.

From this illustration it will be seen that the value of a project as a teaching device may be very great. Some teachers are so well convinced of this that they try to teach entirely by the project method—that is,
to organize all the teaching and all the subject matter around a chosen set of projects. This has proved to be very successful in connection with vocational agriculture in America, where the students are few and considerably advanced, and may have land and facilities at the home farm, where they can carry out their projects of corn growing or pig raising and the like, in connection with a well equipped rural school. The project method as an exclusive method is, however, difficult to use successfully in many other kinds of school situations.

XI. THE "DALTON PLAN"

The so-called "Dalton Plan," about which there is at present so much interest in China, is simply a plan of school management devised for the purpose of using the project method exclusively. If used by very skillful, experienced, and resourceful teachers, with small classes of pupils who are of higher than average intelligence, and with abundant laboratory and library facilities, it is undoubtedly an excellent plan and ought to be highly successful. Unless, however, all these circumstances are favorable to it, it cannot be successful and should not be tried. It is being tried out under expert supervision in the practice schools of the National Southeastern University, where the students are being carefully tested in comparison with those taught in other ways. It is there reported that the "Dalton Plan" is working fairly well in some classes, but not in others.

XII. RELATION OF PROJECTS TO MORE FORMAL METHODS

With these words of caution it is proper to advise that the science teachers introduce projects into their courses gradually, and use as many of them as they can handle successfully. If they will do this they will probably find that they
can use more of them as their experience with them increases, and that the use of the projects will make for a general improvement in the results of all their work. Yet, there will always be a necessary place for some of the more formal methods, and for many kinds of methods. It is therefore best for the teacher not to become a faddist and allow himself to be carried off his feet by too much admiration for any one kind of device or any single method of teaching.

The best rule is to keep an open mind, try out new things cautiously, testing them by their results, and improve the teaching practice by elimination of the unsuccessful and selection of the successful; in other words, keep alive and growing, but let the changes be by evolution, not by revolution.
CHAPTER 15

THE TEACHERS IN ACTION. THEIR METHODS SUMMARIZED

I. HOW THE OBSERVING WAS DONE

Observations of classroom work, and of laboratory work where it was to be found, were made in one or more of the sciences, and sometimes also in mathematics, English, and other subjects in nearly every school visited. In science, especially, effort was made to get into every class that was running during the visit in the school. I was always accompanied by one interpreter, and usually by two. We entered with as little disturbance as possible. In many cases when they had been so requested before our arrival, the teacher and students paid no attention to us, but went straight on with their work. In many of the schools, the custom is for all the students to rise and bow when the principal enters with visitors. After returning the students’ salutation, and bowing to the teacher, or being formally introduced to him, we would take seats in the center or rear of the room, and everything would proceed as usual.

The interruptions for formalities were always brief. My usual practice was to sit between the two interpreters, and keep them both busy telling me what the teachers were saying, and what the pupils said on the few occasions when they asked questions or replied to questions put by the teacher. After leaving the room, we usually consulted, and discussed briefly the main characteristics of the teacher, of the instruction, and of the students’ reactions. Notes were taken during the class work; and often these were added to, after conferring concerning
what we had observed. In this way rather full and care-
ful field notes were kept of all distinctive points in the
instruction; but the notes were very brief in the cases
when the procedure had no distinctive features that
represented either especially good or especially bad
practice.

One of the most surprising of the observed general
characteristics of the class work was that there was so
little difference in the content and method
of instruction as among the different
types of institutions. Taking general
chemistry for an example, it was to a prevailing extent
the same subject matter and taught by the same method,
in middle schools, normal schools, higher normal schools,
agricultural schools, technical schools, and in many of
the colleges. Often the same teacher teaches the subject
in two or three of these different types of institutions.
There seems to be a line of promotion from the middle
schools through the normals to the higher normals and
colleges, and in general one finds the teacher progressively
more experienced and skillful as he passes from the lower
to the higher type of institution. This, however, is by
no means always true.

There is not enough difference in the methods of
instruction used in the different types of schools, to
make a separate treatment of them worth
while or even feasible; hence the ex-
amples hereafter given in this and the
following chapter may serve to represent the methods
of teaching that prevail in all the different types of
schools.

II. THE METHODS USED BY THE TEACHERS

More than half the teachers that were observed used
the formal lecture method almost exclusively, making
little or no attempt to get responses of any kind from
their students—not even requiring them to take notes of
the lecture. Most of such teachers used the blackboard
freely, making diagrams, drawings, or outlines as they talked. A few did these things very rapidly and skillfully; but the skillful ones usually do not belong in the same class with those who use the formal lecture exclusively. As a rule, the more closely the teacher stuck to lecturing exclusively, the less skillful he was even in the technic of lecturing itself.

In lecturing, the most common faults observed were:

1. Not using sufficient experiments, demonstrations, or such visual aids as specimens, charts, maps, pictures, models, lantern slides, microscopic preparations, etc.,—even when such visual aids were to be found in the school equipment.

2. When demonstrations, experiments, or specimens were presented, sufficient care was not often taken to make sure that every student saw what he was expected to see, or even that all had the opportunity to do so.

3. Sometimes, though far less commonly, the teacher did not speak loudly and clearly enough to be distinctly heard by all.

4. In the case of a very large proportion of the lectures, the teachers presented only the facts, experiments, and problems in the textbook, almost in the same order and with the same lack of elaboration. Since the prevailing textbooks are, for the most part, mere condensed collections of dry facts, there could be nothing inspiring or stimulating about such a lecture.

5. Most of the teachers fail to push their experiments and demonstrations to a point of sufficient completeness. The result is that these experiments are not logically convincing to the students. For this reason the students fail to understand the significance of an experimental demonstration. A principle or general statement always requires much evidence and many kinds of evidence to establish it as a general truth or
even as a working hypothesis. Enough experimental evidence should be presented to make the line of argument clear; and every experiment presented should be pushed far enough so that its relation to the complete proof becomes perfectly evident. A clear explanation of the experiment should always be given; or called out by questioning; and additional facts that support the same conclusion should be cited. Also any facts that tend to contradict the conclusion should be considered and explained. When this is not done the students fail to get an analytical, scientific attitude towards facts and experiments.

Although such faults were common among the majority of teachers whose work was observed, there was a considerable minority who avoided many of them to a greater or less extent.

A few of the teachers used the informal lecture method quite successfully, interspersing their lectures with questions, to direct observation and check comprehension. Hardly any of them, however, avoided the fault of asking their questions in such a way as to get "volley" answers. That is, they allowed the students to answer all at the same time; and since their answers were various, this resulted in a confusion of sounds from which no distinct ideas could be picked out by any one. No one could tell whether any one answer was correct and logically connected with the question. On rare occasions, the students themselves asked questions, and when they did so, these questions were usually answered carefully and clearly by the teacher. In a majority of the cases in which the recitation method was tried, volley answers to thought questions were common, and individual answers rare. The most of the questions asked were memory questions, but the approved methods of conducting memory recitations were not used. Cases of thoroughly good and consistent technic with thought questions were exceedingly rare.  

1 Cf. Chap. 13.
Only a single case was observed in which the teacher required the students to work out the solutions to geometrical, physical, or chemical problems, either on paper at their seats, or on the blackboard. In this case, instead of sending several students to the board at once, the teacher sent them one at a time, and had the entire class wait while each made his diagrams, or calculations. This, by the way, was an American, teaching in a government college, who it seems should have had opportunities (such as the Chinese teachers mostly have not had) for learning more economical methods.

Laboratory work of any sort was rarely provided for or could be observed in middle schools. Those in which such work is carried on at all are exceptional. The same is true in the normal schools.

In the higher normals and technical schools one usually finds some very good laboratory instruction in chemistry. In biology and in physics it is more rarely to be found.

Really excellent laboratory and classroom instruction was observed in the middle schools of the National Southeastern University in Nanking, and Nankai College, Tientsin. Also good work was seen in the middle school of Chung Wha University, a private institution in Wuchang. These schools, and more particularly the first of them, have well equipped laboratories. So have the first middle school in Nanking, Wayland Academy in Hangchow, and the Union Christian Normal School in Wuchang.

In Ichang, in one of the middle schools, we found an especially talented and wide-awake teacher, who was introducing modern classroom and laboratory methods notwithstanding the fact that the school had no special laboratory room, and only a limited amount of demonstration apparatus.

Some excellent laboratory and classroom teaching was witnessed in Tsing Hua College, Peking, Peking University (Union Mission), Peking Union Medical College Pre-medical School, Shantung Christian University, Tsinan, Shanghai Baptist College, and the National Southeastern
University, Nanking. Some very good teaching of both sorts was found in various departments among such institutions, as the Peking National Higher Normal, the Wuhu Agricultural School, the Girls’ Normal in Tientsin, and Nankai College, Tientsin.

The National University in Peking has a large equipment in the sciences, to which additions for more up-to-date types of laboratory instruction have recently been added. This institution has in its faculty some of the ablest and best known scholars in China, among them, Dr. Hu Shih, the eminent literatus, and Dr. A. W. Grabau, formerly of Columbia University, an internationally known authority in geology and paleontology. The institution has suffered severely of late from the failure of the central government to provide the customary revenues for its support. Consequently its organization is not running smoothly. I was able to witness only one science lesson there. The teacher lectured in English, and used no visual aids excepting the blackboard. His lecture was abstract and not very interesting. He is more interested in research than in teaching. He took his doctor’s degree from one of the leading American universities, is well trained as a scientist and is regarded by the Chinese as one of their leading men in his subject.

Some good laboratory equipment in one or more science branches, and also well-trained teachers, are to be found in the Girls’ Higher Normal, Peking; the National Peking Technical College; Pei Yang University, Tientsin; Nanyang University, Shanghai; the two technical institutes in Shanghai and Woosung; Nanking University, Nanking; Soochow University, Soochow; Boone University, Wuchang; the Central China Christian Normal School, Wuchang; and Griffith John College, Hankow. St. John’s University in Shanghai has a new science building on modern lines and is getting in a good equipment and well-trained teachers in the fundamental sciences. Canton Christian College, Amoy University, Fukien University, and Yale-in-China, which I have not had opportunity
to visit, are reported as having each some outstanding equipments and also some well-trained men who are contributing both in teaching and research lines to the advance of science in China.

III. REPORTS ON METHODS FROM THE QUESTIONNAIRE

In the questionnaire sent out to the science teachers, the following questions were included. About what per cent of your class time do you use in lecturing? what per cent in asking and getting answers to memory questions? what per cent in asking and getting answers to questions that are of a problematic nature, requiring thinking or numerical calculations in order to reach conclusions?

The table on page 210 shows how about half of the teachers estimate the distribution of their time among these three types of classroom activities.

The ninth line from the top, for example, may be read: "Four out of 75 teachers, who answered, estimate that they devote from 40 to 45 per cent lecturing, three out of 71 devote 40 to 45 per cent to memory questions and answers, and 3 out of 70 devote from 40 to 45 per cent to thought questions and answers."

Of those who estimated their lecture time, the most frequent estimate (mode) is 50 up to 55 per cent.

Of those who estimated their memory activity time the mode is 10 up to 15 per cent.

Of those who estimated the time given to thought activities, the mode is 20 up to 25 per cent.

The corresponding medians are 62.5 per cent for lecturing, 16.8 per cent for memory work, and 24 per cent for thought work. This means in each case that half the teachers answering spent more than that per cent of their time in the specified way and the other half less than that per cent of their time in the same way.

There were 62, 66, and 67 teachers, respectively, who could not or did not estimate the time given to the kinds
<table>
<thead>
<tr>
<th>PERCENTS</th>
<th>LECTURING</th>
<th>MEMORY QUESTIONS</th>
<th>THOUGHT QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 up to 5</td>
<td>2</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>5 , , 10</td>
<td>7</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10 , , 15</td>
<td>23</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>15 , , 20</td>
<td>11</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>20 , , 25</td>
<td>3</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>25 , , 30</td>
<td>35</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>30 , , 35</td>
<td>35</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>35 , , 40</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>40 , , 45</td>
<td>50</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>45 , , 50</td>
<td>50</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>50 , , 55</td>
<td>60</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>55 , , 60</td>
<td>65</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>60 , , 65</td>
<td>70</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>65 , , 70</td>
<td>75</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>70 , , 75</td>
<td>80</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>75 , , 80</td>
<td>85</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>80 , , 85</td>
<td>90</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>85 , , 90</td>
<td>95</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>90 , , 95</td>
<td>100</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>ANSWERING</td>
<td>75</td>
<td>71</td>
<td>70</td>
</tr>
<tr>
<td>NO ANSWER</td>
<td>62</td>
<td>66</td>
<td>67</td>
</tr>
<tr>
<td>TOTAL</td>
<td>137</td>
<td>137</td>
<td>137</td>
</tr>
<tr>
<td>MODES</td>
<td>50-55</td>
<td>10-15</td>
<td>20-25</td>
</tr>
<tr>
<td>MEDIANS</td>
<td>62.5</td>
<td>16.8</td>
<td>24.0</td>
</tr>
</tbody>
</table>

of activity specified. It is probable, I think, that the greater proportion of these lecture all or nearly all of the time. Suppose we assume that these teachers really give 90 to 95 per cent of their time to lecturing, 0 to 5 per cent to memory work, and 0 to 5 per cent to thinking activities. Then the medians would be changed to 83.9 per cent for lecturing, to 5.4 per cent for memory work, and to 2.5 per cent for thinking activities. Judging from my classroom observations I am inclined to think that for the whole body of middle school teachers this latter distribution of their time is more nearly typical than that indicated by the medians corresponding to the teachers
only who answered the questions. Those who answered probably represent a small selected group of the most careful and thoughtful of the teachers,—those whose practice is much better than that of the very great majority.

In China there is a good deal of talk and inquiry about the project method. An attempt was made in the questionnaire to find out to what extent attempts are being made to use this method. The question was put in this way: "Do you ever use the 'project method' of teaching (that means letting individual students or small groups of students choose and complete a special task or undertaking that requires some independent study, investigation, or experimenting to carry it out)? If so, how many such projects did you have worked out last year? Please name briefly or describe two or three of the projects from which your students seemed to get the most benefit."

Only 12 of the 137 middle school teachers who replied to the questionnaire answered this question at all. We had hoped to get from it some good projects to recommend to the teachers. Only a very few of the answers, however, gave any information of value.

These are the answers:

50 per cent of the time is given to laboratory work ... ... 2
25 per cent of the time is given to laboratory work ... ... 2
Some time for laboratory work ... ... ... ... ... 1
4 or 5 projects during last year... ... ... ... ... ... 1
Sometimes but not much ... ... ... ... ... ... 1
Sometimes ... ... ... ... ... ... ... ... ... 1
Discussing chemical problems, — more than 200 last year ... ... 1
5 or 6 times during last year ... ... ... ... ... ... ... 1
  a. Investigating food materials ... ... ... ... ... 1
  b. Methods of pruning fruit trees; soil investigation
     Making ink ... ... ... ... ... ... ... ... 1
     Making violet quartz. Making mercury into mer-
     curous nitrate ... ... ... ... ... ... ... 1

These answers, together with information gathered in the schools, show that some significant projects of a modest sort are being carried out in the schools, but that attempts to use the method are few and widely scattered.
There is not generally a clear conception of what a "project" is.

IV. HOW THE TEACHERS CAN HELP THEMSELVES

It is recommended that the principals of schools actively supervise the work of the teachers. As soon as possible, courses should be established in one or more of the national universities and teachers colleges providing instruction for them in the principles of supervision and the criteria for judging the quality of teaching in the various lines of middle school work.

The principals should work constructively, calling attention to both the good and the faulty procedure in the work of the teachers. They should encourage the teachers by commending their good points in teaching and showing wherein the good may, if possible, be improved. They should also point out the faulty practices and suggest to the teachers how they may eliminate these. Teachers who make steady improvement should be commended; and if there should be any who do not improve within a reasonable time, wise and tactful pressure should be brought to bear on them to the end that they be stimulated to greater ambition and professional growth. The teachers may help themselves to improve in many ways.

These are some of the things they should try to do:

1. Make themselves complete masters of the subject matter and of the technic of experimenting for every lesson before giving it. This means definite time spent in making a written plan for the lesson and in practicing and making preparation to carry the plan through.

2. Progressively, and as rapidly as possible, cut down the amount of lecturing until it occupies not more than one fifth or one tenth of the time. Instead, develop more of teaching by recitations, class conferences, and discussions, laboratory practice, projects, topical recitations, and library reference work.
3. Use to the utmost the facilities and apparatus on hand. Begin at once to improve its condition, and add such pieces as can be "homemade." Arrange at least a few laboratory experiments to be made with whatever suitable apparatus may be available or can be collected or homemade. Have every student in the class make at least a few experiments himself.

4. Never neglect to use any part of the equipment on hand, when it can serve in any way to make the instruction clearer, or more real and concrete, or more vivid and interesting.

5. Incite the students to assist in preparing demonstrations and experiments for class instruction. Let them frequently assist in performing experiments before the class. Get up a spirit of rivalry among them as to which can show the most skill and helpfulness in manipulating the apparatus and demonstrating with it. Let them help in getting it out, in cleaning it and putting it in order after use, and in replacing it where it belongs in the cases. Encourage them to study the apparatus, and find out all about how it is used in demonstrating principles and verifying laws of science. Encourage them to be careful and exact, so as to get accurate results.

6. Insist that each student keep a carefully prepared notebook, and make adequate notes on all the most important parts of the instruction — especially on every laboratory experiment, and on every demonstration made by teacher or pupils before the class.

7. Do less talking yourself and make the students do more. Have them discuss in the classroom the conditions and results of experiments and demonstrations. Have them state what is proved, and why the conclusion must logically be what it is and nothing else.

8. Call out the self-activity of the students by appealing to their interests. Connect the lesson facts and principles with the everyday personal and community
interests of the students. Try to get more of your practical applications of science from among those which can be observed in Chinese daily life. Most of those in foreign textbooks are in comprehensible to the students because they have never seen anything like them. They can study Chinese devices and applications at first hand. Ask them many questions about the ricksha, the Chinese lathe, the windlass, pulleys, etc., the making of matches, the rearing of silkworms, etc., by way of bringing out the principles of the sciences. Get them to explain to the class what they have observed, and to what conclusions these observations lead.

9. Construct, or have constructed as much as possible, of good homemade apparatus, mounted biological specimens, charts, models, etc. Have the students assist in this, or assign such work to groups or individuals as projects. Try to use the project method as much as is practicable. Even a few projects are better than none at all.

10. Help on methods can be found in the next chapter, also in the following books:
   Twiss, G. R., "The Principles of Science Teaching" (Macmillan, London and New York); Lloyd and Bigelow, "The Teaching of Biology" (Longmans, London and New York); Smith and Hall, "The Teaching of Chemistry and Physics" (Longmans); Ganong, "The Teaching Botanist" (Macmillan).

11. Form immediately a science teachers’ club, for discussion and cooperative reading of such teaching helps as have been referred to. Meet at least once a month and exchange experiences. Let each member attend the meetings faithfully, and have some piece of apparatus or experiment to exhibit, or some idea to contribute to the discussions.

If through the agency of teachers’ clubs for mutual intervisitation of classes and discussion the leadership

---

1 This book has been translated into Chinese, and will soon be published in China.
and progressive spirit of the outstanding and superior teachers can be capitalized for the benefit of the younger and less experienced, and for mutual helpfulness, great improvement in methods of teaching and in school equipments may be rapidly brought about. A bulletin has been prepared for circulation among principals and science teachers, telling in detail how to organize and carry on the work of such clubs. It may be obtained by applying to the Chinese National Association for the Advancement of Education, Peking.
CHAPTER 16

SELECTIONS FROM THE FIELD NOTES—
WITH CONSTRUCTIVE CRITICISMS

I. "MOVING PICTURES" FROM THE
   SCHOOLROOMS

THIS chapter is made up of "word pictures,"
selected from my notebook, from among descrip-
tions of teaching procedure written down during visits
in hundreds of classrooms and laboratories while the
activities that are described were actually going on.
Designedly, they represent much more of the best
teaching observed than of the mediocre or poor
teaching.

It is hoped that they will prove to be readable
to all who are interested in science education in
China; but they ought especially to
be very helpful and instructive to the
science teachers, and to the professors
in the higher institutions whose re-
sponsibility for the training of science teachers is
unescapable. Their concrete and specific character ought
to make them useful for study and discussion both in
institutes and university courses for the training of
science teachers, and in teachers' clubs and round-table
meetings.

Names of cities or of schools are omitted, as it is ob-
viously undesirable to bring any particular individual
or school or city into public comparison with another.
Accordingly, in order to prevent identification, numbers
are substituted for the names of cities, and letters for
those of schools.
II. Notes from City Number 1

1. There are, then, three kinds of questions:

Kinds of questions.  (1) Questions for memory drill or memory testing,
(2) Questions to stimulate and direct observation,
(3) Questions to stimulate thinking, that is, questions of a problematic nature.

A question should have the following characteristics:

a. It should be brief, concise, and stated without hesitation or change.

b. It should be clear, unequivocal (admitting of but one meaning).

c. Unless it be a topical assignment it should call for only one idea.

d. It should not be such as to suggest its own answer.

e. It should rarely if ever be capable of being answered by "Yes" or "No," for in such case the chances are even that it will be correctly answered by the student if he merely guesses without knowing anything at all about the subject.

f. In general, it should not be such that it can be answered by a single word or phrase (excepting in memory drills with "paired associates") (see chapter 13, ante).

g. The proportion of thought-provoking or problematic questions should be much greater than the proportion of memory questions.

h. Memory questions should be put one after another in rapid succession.

i. In presenting a thought question, the teacher should first state the question, then give the students from ten to thirty seconds for silent reflection, then indicate
which student shall answer. With thought questions, students should be trained not to answer until called on individually.

2. A few questions of the first sort were heard in the schools, but they were very ineffective; because only a few students answered, and no attention was given in the case of any question to the task of making sure that all the students should make the correct response.

3. In the case of one teacher who was developing the law of images in a plane mirror, some good questions of the second sort were asked, which were effective in directing the attention of the students to the particular facts, conditions, and phenomena to be observed in the experiment which the teacher was making before them.

4. In not a single case did we hear any questions asked or answered that belong to the third and by far the most important class. Pupils should be encouraged and stimulated to ask questions of the teachers and of one another, and they should be incited to criticize one another’s answers.

The recitation should often take the form of a round-table discussion or conference to which each student is made to feel that he must make some contribution towards reaching the correct conclusion about the matter under discussion.

5. Blackboards should be at least four or five times as long as they are in these schools, extending along the full length of at least two of the walls of the room. On many occasions, from five to ten or more students should be sent to the blackboard each to make a diagram or illustration and work out a solution of some problem or an explanation of some phenomenon or principle. These students should be called on in turn, each to demonstrate his problem, or prove his statement or conclusion, or make his explanation, with the aid of the diagram and formulæ which he has placed on the blackboard. After such a demonstration
or explanation by a pupil, the teacher should call on
the other pupils to question, or to criticize, or to state
their own difficulties in case any of them have not clearly
apprehended the explanation. When a pupil is making
such an explanation he should give reasons for every
statement, and if he omits any such reasons, the other
pupils or the teacher should ask for them.

When several pupils are sent to the blackboard to
draw diagrams and write formulæ in
preparation for such explanations, the
remainder of the class must not be allowed
to remain idle. They should be given
rapid review and practice in working
simple problems and answering memory
questions and easy thought questions, while those who
were sent to the blackboard are preparing their diagrams
and solutions. The teacher should have such review
questions prepared before coming to the class. He should
watch the students at the blackboard and see that they
work rapidly, so as not to waste time.

6. For such recitations as have been described, the
pupils must prepare themselves by study
outside the classroom; and they will
then learn to study independently. However, when the teacher assigns the lesson
for outside study he should instruct the
students in the best ways of attacking it for study, and
should explain some of the most difficult points in the
lesson, if there are in it any difficulties that are too
great to be resolved by pupils of average ability without
help. This step is called the assignment of the next lesson,
and is very important.

7. Some very good laboratory work was observed, but
in all the schools there is far less of this kind of teaching
than there should be. In a normal school, laboratory
practice was observed in chemistry. The
pupils were making acetylene on the
desks in the classroom, for there are no
special laboratory rooms in this school.
The boys were working in groups of three or four, since there was not enough apparatus to allow them to work singly. The work was conducted fairly well, and the boys appeared to be much interested; but the teacher's supervision was not as effective as it might have been. For example, when the boys burned the acetylene and tested the contents of the bottle for the resulting CO₂, the hot CO₂ when formed mostly escaped into the room. When shown by the writer how to use a second bottle to confine the products of combustion, the boys were entirely successful. The teacher should have directed them to use this precaution.

A laboratory manual or mimeographed direction sheets should be given them. These directions should tell them quite fully what to do, what to look for, and how to record their observations and inferences in their notebooks. The teacher should give oral instructions to supplement the printed directions. These should be given to the class as a whole or to individuals when needed. The teacher should pass among the students, observing their work and giving such needed instruction. By this method he can train them in a good technic of experimenting and keeping notes.

This teacher should be commended for finding a way to carry out laboratory work in spite of the lack of a room especially adapted for the purpose. He has shown by his interest and enterprise that it is possible to carry on laboratory instruction with very limited equipment if only the teacher is determined to accomplish it. There is really no excuse for not carrying out some laboratory instruction in every science taught in any of these schools.

8. In this same school some laboratory work in botany was observed. The teacher explained the plan and structure of the ray and disk flowers of the Compositae. He showed specimens, and drew excellent diagrams.
and sketches on the blackboard with great skill and rapidity, outlining the features to be observed. He then distributed to each of the students several specimens of different composite plants; and the students promptly began to sketch them, to diagram their details of structure, and to label the parts. All the students had lenses and some simple dissecting instruments; and they used these. They drew excellent diagrams. The drawings in their notebooks were generally very good. In fact, they would average better in quality as diagrams than those made by American pupils of the same grade. The notes were systematically arranged; and the books almost without exception presented an artistic appearance. The drawing was generally done quickly also.

9. In the Girls’ Normal School there is a laboratory for chemistry, but we did not observe any laboratory practice in it. Judging by general appearances and by the kind, condition, and amount of the apparatus equipment, we inferred that very little laboratory practice is given in this school, although the classroom lecturing was good for that kind of work. The teachers seemed to be developing their subjects clearly and logically, with plenty of illustration by diagrams and plenty of outlining of the main facts on the blackboard. They occasionally asked questions; but these were too infrequent. They called for memory answers only, only very few students responded to them, and often also the responses were far from being of a satisfactory character.

10. In the higher normal school it was not possible during our stay to see any laboratory work; but here the laboratory equipment is such as to make it possible to carry on laboratory work approximating in amount and quality to that done in small American colleges of standard grade. The only work of instruction seen here was in teaching physics, which was lecture work, not equal in teaching quality and interest to that observed in the
lower normal schools. The condition of the laboratories in physics, biology, and chemistry, however, indicated that the teachers have good conceptions of how such work should be done in general college courses.

11. In the C Middle School we observed a small class at laboratory practice in chemistry. They were making sulphuric acid by the chamber process, with the usual laboratory form of apparatus for this experiment. There were five or six students to each set. The apparatus was well set up; and the students were carrying out the experiment successfully; but there was little or no note taking of a careful and satisfactorily systematic character.

12. In this school there were among the exhibits of handwork two features of great interest. The first consisted of two models—one of a coal mine showing its structure and the operations of mining, the other of a harbor. These we were told were made by students after a visit to these centers of geographical interest.

The second interesting exhibit consisted of a large number of models illustrating the various theorems of solid geometry. These were large and exceedingly well made. We found on inquiry, however, that these models were made simply as exercises in handwork, and were constructed after and not while the boys were working through the study of solid geometry. If these models had been made by the boys while they were studying the propositions that the models illustrate, they would have been of several times the value that they have had when made afterwards; because by actually constructing the models the boys would have gained better insight. Through making and handling these concrete models of such abstract ideas as lines, planes, and solid angles, the students would understand better the geometrical relations. These abstract space relations are very hard to understand from plane diagrams; and such large and splendidly made models would have given the boys better apprehension
of these difficult relations. Also the making of these models is a kind of project that would help create interest in the study.

The great advantages of models and apparatus made by students. It is recommended to all the teachers of geometry and arithmetic in the city, that they go to inspect these models, and provide in their lesson plans for having their pupils construct and use similar ones while studying mensuration of solids, or solid geometry. Teachers of other subjects ought also to get a hint from the exhibits in this school of making models to illustrate objects of study in geography, geology, history, and civics. In giving this advice, however, a little caution is necessary; for many examples are found here of models that have consumed much time in the making and yet have little or no significance. For example, there is a model of a telephone instrument which imitates only the external appearance of a real telephone, but shows not a single essential feature of its working mechanism. If the boys had constructed a pair of real telephones that would work, they would have completed a project of real value — one worth a considerable amount of their time.

This whole subject of making apparatus and models is commended to the teachers for thorough debate and discussions in future round tables which it is hoped they will hold in accordance with recommendations that we have made to them.

13. In the D Middle School we saw a laboratory lesson in chemistry. The experiment was the making of chlorine and the testing of its chemical properties. The laboratory was crudely and meagerly furnished and the apparatus scanty. The teacher is to be commended for carrying on laboratory work under difficulties; but he needs to give careful thought and study to the problem of better laboratory teaching. He is not succeeding in
training his students into good and efficient habits of handling apparatus. These boys were very awkward and bungling in the way they handled the apparatus and materials; and unfortunately the teacher did not help them by showing them better ways.

14. In this school the teacher of physiology made unusually good use of the physiological charts, such as have been supplied to nearly all the schools. In describing the circulation of the blood he used three different charts, and kept constantly referring to the parts of the human body represented by the charts and comparing these with his own body. Here he was not only making the process clear and making the abstract circulation diagram concrete, but he was giving the whole subject an atmosphere of personal interest and reality. This teacher ought to introduce some laboratory lessons in physiology with the materials he has on hand and with other materials that he could easily buy from the meat markets. He would thus make his teaching still more effective, and furnish an example for other teachers to imitate.

15. The technical school has an immense amount of apparatus and material which could be used for a good quality of laboratory work; but excepting in chemistry and mineralogy no laboratory practice is given. The teacher of chemistry and mineralogy is the author of a textbook on mineralogy; and is evidently well trained in his subjects. He is very alert in managing his class in the laboratory. In the technic that his pupils have acquired and were using in blowpipe and other analytical examinations of substances, these boys gave evidence that they have been carefully trained. The apparatus and materials in this department were well cared for and systematically arranged. This was quite
All apparatus needs better care, more systematic arrangement, more room, and more cases. in contrast with the apparatus in other departments, where there was a great amount of material that has been misused or has not been used at all. Even in this department, a large part of an extensive collection of minerals and rocks was kept in open trays, and the specimens contained in these trays were covered with a thick layer of dust. Dust and dirt obscure the specimens so they cannot be easily studied. Also, students dislike handling dusty articles. For both these reasons, therefore, specimens that are not kept clean are nearly useless for class or laboratory demonstration and study. This condition of exposed and dusty specimens and apparatus was found to prevail to a very large extent in every school. The remedy is of course to provide covers of glass or wood for all specimen boxes, and to provide more room and more cases for biological specimens, models, charts, and physical apparatus. Such cases should be made dust-tight by placing strips of felt around the edges of all the doors.

III. Good and Faulty Procedure from City Number 2

1. Chemistry. Good. This teacher did not lecture exclusively, but from time to time asked several questions of individual students, which were usually answered quite promptly. A few of these questions were such as would make them think as contrasted with merely remembering something learned by heart. The teacher’s explanations were clear and logical. He occasionally asked questions to find out the difficulties of the students, and then he would clear up these difficulties by more careful explanation.

Faulty. He was making the experiment of burning hydrogen gas, and showing that the product of combustion
is water, which was being condensed on the inside of a bell jar placed over the flame. Although the experiment was successfully carried out, a very serious defect in the teaching was that the teacher did not make sure that every student in the class should see with his own eyes and recognize the water vapor which arose out of the flame and condensed on the inside walls of the bell jar. He should have made them all see, first that before the hydrogen burned within it, the bell jar was dry, and second, after the hydrogen had burned within it the bell jar became wet with drops of water which united and dripped down the inside of the jar.

A few of the students approached the table and observed this, when the class was dismissed; but the most of them did not see it at all from their seats, and did not go forward afterwards to look. The teacher did not direct them to do so; and they did not think of it themselves. Within a minute after the bell rang the teacher himself had gone, and the apparatus had been hustled away by a servant to make room for a lesson in another subject. The teacher should have planned and carried out the lesson so that every pupil would have seen and understood every essential feature of the experiment.

2. Physics. Good. This teacher uses more and better questions and gets fuller and more thoughtful answers from his pupils than any other teacher yet observed. His development of the subject is clear and logical, and he keeps the attention of the students fixed on the experiments and demonstrations while he is teaching.

Faulty. No individual laboratory work is done by the students in this class, although it would be possible to provide a very good number of laboratory experiments with the apparatus that is available.

3. Physiology. Good. The teacher evidently knows the subject well, and he developed the lesson logically, with good attention to the relation of structure to
function. He used a wall chart of the skeleton and supplemented this by blackboard diagrams.

Faulty. Although his development of the subject would have been very interesting otherwise, it was slowed down and made tiresome by the fact that he could not draw and talk at the same time. He had to stop talking while drawing; and he drew very slowly — quite in contrast with one or two other teachers who were conspicuous because of the wonderful rapidity and skill with which they could draw diagrams while they explained the features that they were drawing. This gift is not possessed by many teachers in such a high degree, but all should seek to perfect themselves in it by practice, to the best of their ability.

Besides his slowness in drawing, this teacher fell short in another way. There was a good skeleton in the stock room, which he should have been using along with the chart and blackboard illustrations. He should have been teaching (and habituating) his students to observe the actual objects when available; and since the skeleton was available there was no excuse for not placing it before the pupils and seeing that every student examined it. This failure to use actual material for observation and study, and the tendency to rely wholly on spoken or printed words and diagrams is one of the worst and most common faults of teachers of science in China; and it is a fault of many of the foreign teachers as well as of most of the Chinese.

4. Physics. Good. The teacher is very energetic and enthusiastic. He gets good attention. He asked a few questions.

Faulty. He did not address his thought questions to individuals, but to the class as a whole; and so ten or fifteen students would give their answers at the same time. The result was a confusion of sounds. These
students.—First give the question then name the students who shall answer it. Allow a little time for reflection.

"volley" answers are of no use in instruction because in the confusion of sounds the right answers cannot be distinguished from the wrong ones.

In trying to demonstrate Boyle’s Law with the hook-shaped tube he did not know how to manipulate the tube and the mercury so as to start with the mercury at the same level in both arms of the tube. Also he did not read the barometer to determine the pressure of the atmosphere at the time, but assumed it to be exactly seventy-six centimeters. The result was that the relation of pressure to volume, as indicated by the observations made, were not in accordance with the law. Such unskillful and faulty experiments and teaching represent the very opposite of training in scientific accuracy and precision of thought. China can never come to profit by the benefits of applied science until her students are trained to experiment accurately and reason precisely from the conditions and results actually observed. Such inaccurate experiments as the one just described, and as many others that have been witnessed, are training the students to be inaccurate, and allowing them to think that accuracy is of no importance.

Faulty experimenting trains students to be inexact and unscientific.

Another fault of this demonstration was that in the experiment only two changes in pressure with the corresponding changes in volume were noted. Two cases are not enough from which to infer a general law.

5. Physiology. Good. This teacher uses the recitation method, calls on his pupils singly, and usually makes a pupil answer two or three questions, keeping him on his feet until he has made a clear, logical statement about the topic under discussion. The students were
interested, and they responded quite willingly. A good example was noted here of how pupils may be made to think in concrete terms. The teacher asked a pupil how long the human intestine is, and he answered to the effect that if the intestine were laid out on the floor it would reach from one side of the classroom to the other side. To get students to think of scientific things in such concrete and familiar terms as this is excellent. This teacher is inexperienced, and his teaching technic is very imperfect; but he has in him the makings of an excellent teacher.

Faulty. No illustrative materials of any sort were used. It was entirely a book recitation. This lack of equipment might have been overcome at least to some extent if the teacher had made wall charts and diagrams himself, or had his students make them, or if he had made a dissection of a rabbit, or even if he had secured some of the needed kinds of materials from a meat shop. Even the simplest materials that can be obtained are better than no demonstration objects at all.

6. General Science. Good. The teacher used the question and answer method with fair success. The students responded with interest, and seemed to be quite well prepared by study outside the classroom.

Faulty. Too large a proportion of the questions called for mere memory responses, and too few called for thought-out responses. The teacher brought into the lesson quite a number of chemical facts and principles which the students did not need for the comprehension of the subject under discussion, and which they had no opportunity to study by observation and experiment. Hence the introduction of these chemical ideas served only to confuse and mystify them. This habit of bringing into a lesson ideas that are beyond the comprehension of the students is a very common fault of science.
teachers. It prevents their students from forming habits of clear and logical thinking. It is nearly always caused by neglect on the part of the teacher of carefully preparing his lessons before giving them. He should select beforehand the ideas which he is going to impart, and arrange them in a logical outline or written plan for giving the lesson.

7. **Botany.** Good. The teacher is lecturing on the parts of the flowering plant, especially the parts of the flower. He holds up the flower before the class, shows the parts, and then with great rapidity draws on the blackboard beautiful diagrams of the flower and its parts, labeling these with the corresponding Chinese characters. His skill in drawing compels admiration.

**Faulty.** The serious defect in his method of teaching lies in the fact that it does not appeal to the self-activity of the students. In the first place they get no opportunity to examine the flowers themselves, for he has not provided enough so that each student or even each pair of students may have one to handle, dissect, and examine closely. When he holds up a flower before them they are not able to distinguish the parts that he is showing. In the second place as a result of the first difficulty the students *copy* his drawings. Such methods do not train pupils to observe and record what they observe. They produce copyists. *Instead, the students should observe the parts of the real flower for themselves and draw what they actually see.*

Each student should have been given a plant to dissect and observe; and then the teacher’s instruction should have been aimed at directing the students what to look for and how to record, interpret, classify, and apply the results of his observations.
8. Chemistry. Good. The only really good thing about this teacher’s lesson was that he had the apparatus set up on the demonstration table ready to make a very striking, interesting, and instructive experiment.

Faulty. He did not make experiment, but spent all the time lecturing about it and telling what he was going to do. He was a very slow and uninteresting talker and the students were evidently bored. He talked for twenty minutes in telling what could easily have been made plain in five minutes. He spent time drawing on the blackboard a diagram of the apparatus for the students to copy, although the apparatus itself was in plain sight. The students should have drawn the apparatus itself instead of copying the teacher’s diagrams.

Good practice in this case would be for the teacher to have proceeded at once, step by step, to make the experiment and to make sure by questioning as he went along that the students observed and understood the essential facts and ideas in their logical order. He should then lead the students to discuss the experiment with him, and with one another, until every feature of conditions, the phenomena, and the inferences logically growing out of these were thoroughly understood and recorded in the student’s notebooks.

9. Physiology. Good. This teacher used charts and made excellent blackboard diagrams to explain the structure of the mouth, the tongue, the jaws, and the teeth, and the arrangement and functions of the muscles used in masticating food. He connected the structure and functions very well. He asked one question. It was a memory question.

Faulty. There was too much lecturing, and not enough questioning to determine whether the points of the instruction were
thing to see thoroughly understood. There was prac-
with their eyes tically nothing for the students to do but
do with sit and listen. He talked and drew so their hands.
slowly that the students lost interest.
There were in the stock room a skeleton and a manikin which should have been used, but were not. These would have made the facts and principles to be taught much clearer and more concrete, would therefore have aroused more attentive observation, and would have stimulated interest and thought. The procedure in this class was quite typical of that in many science classes seen elsewhere.

IV. EXAMPLES FROM CITY NUMBER 3

1. Physics. This teacher has a very energetic and magnetic personality. His method is a combination of oral exposition and blackboard demonstration with rapid-fire questions. The lesson was on the relations of the Centigrade and Fahrenheit thermometer scales. With the aid of a diagram of the two thermometers placed side by side with their fixed points opposite each to each, he developed the equation \( C. = \frac{5}{9} (F. - 32^\circ) \). This was concisely and logically done. By his combination of telling and questions, the teacher made the relation so simple and clear that it must have been easy for his students to comprehend. This relation is rather elusive; and it is one which students often have trouble in mastering unless it is very skillfully taught — as it was in this case. The teacher passed out samples of the two kinds of thermometers for the students to examine. He then explained the mechanism of the maximum and the minimum thermometer. All of this was well and interestingly done. Evidently the interest of the students was stimulated, for they frequently asked questions; and at the end of the hour quite a number of them came up around the teacher and continued to ask him questions. This is rather unusual in the Chinese schools, although it ought not to be so.
There were two faults in the lesson:

a. When the teacher presented a thought question to the class, he permitted them to reply in a group so that there was a volley of answers producing a confusion of sounds. He should train the students to wait and reflect after the question has been stated until he names a single person, who should then answer it. Then if any students wish to add to the answer or criticize or correct it they should raise their hands. From those whose hands are raised, the teacher should then select, by name, one student, and let him state his correction or make his argument. Others wishing to make a further statement or correction or to ask a question concerning the matter under consideration should likewise be called on in turn, until the answer has been properly stated and understood. This takes a little more time; but the students can soon be trained to think and speak rapidly, clearly, and concisely, so that no time is lost. This method insures close attention and rapid but careful thinking by the students, and enables them all to come through with clear ideas. It also gives the teacher a fine opportunity to estimate the progress of the individual students in mastering the subject. It is customary in America to mark the students each week or each month on the quality of their responses in the classroom, and to average this recitation score with the examination score and the scores on notebooks and special reports, in making up the final standing for the term. This method is much more just than that of determining whether the student shall pass or fail the course on the basis of the examination alone.

b. After the teacher had clearly developed the formula for converting centigrade readings into Fahrenheit and vice versa, he should have required the students to make immediate application of their newly
be given students to make immediate use of knowledge that they have gained. acquired knowledge of this relation by working out a few simple numerical problems.

Also he should have given out a few more problems of a similar sort for them to work outside the classroom and hand in at the next meeting.

In general, practice should be given in applying knowledge immediately after it has been gained. This accomplishes two important things: (1) it impresses on the students the practical value of the knowledge and (2) it helps to fix the facts and relations in memory.

Sometimes it is difficult for a teacher to act strictly according to this principle, but he should do so whenever it is possible. It is always possible at least to tell the students some of the most important ways in which the knowledge that has just been taught can be practically applied; and this should always be done. Often it is better to open up to the students first some practical problem in meeting human needs, — a problem that can be solved only by the application of the particular principles that the teacher wishes to have the students learn. Then after the students have become interested in getting a solution for the problem, the teacher develops the principle inductively, getting the students to furnish as many as possible of the necessary ideas. Finally, after the pupils have comprehended the principle, the teacher leads and assists them to solve the problem by means of it, telling them only what they cannot find out and reason out for themselves by observation and inference. He assists them only when they cannot go on unassisted without too much loss of time. This, very briefly, is the "problem method" about which so much has been said and written in America of late. It is not a new method, but it has only recently come to be valued according to its real worth, and proposed as a standard method of teaching. This was one of the methods that was much discussed by Professor Dewey in his lectures lately delivered in China.
2. Mineralogy. The part of the lesson that was observed was on fluorite. It was straight lecturing. No questions and no discussion. The teacher’s instructions were fairly clear, and given in well organized, logical order. The students have a textbook in Chinese (illustrated). On fluorite it gives only the bare facts, as color, luster, crystalline form, specific gravity, hardness, use as flux, and in etching glass.

The teacher gave considerable information from outside the textbook, and performed the experiment before the pupils of etching glass, in the same manner as is usually done by American students in the school laboratories in chemistry. The students sat with their textbooks open before them, but did not take any notes.

The teacher’s references to commercial uses of fluorite were good in that they tend to connect theoretical chemistry with daily life; but since the students took no notes, how were they to remember these?

A few students only came to the lecture table at the end of the lesson to see the etched glass.

3. Zoology. This is a lecture with occasional questions directed to the class, not to individuals.

These are answered in volleys by a few of those in front. The answers are mostly mere guesses, given with little or no thought. The instruction is purely factual. The teacher draws rapidly as he talks, illustrating the different stages in the life history of the silkworm. The diagrams are of medium quality. — The teacher writes an analysis or outline of the facts as they are developed in the lesson. No specimens were shown; and the intensely interesting facts of silkworm culture and silk manufacture — one of the great industries of China, was scarcely more than mentioned. Here was a great opportunity to connect science with one of the most important and fascinating industries of China, but no advantage was taken of this opportunity.
The silkworm as treated in this lesson was simply an object in an abstract system of biological knowledge, illustrating one of the orders of animal forms. It might have been taught as the essential biological factor in a great field of human endeavor. The relations of its life history, and also the relations of the biological conditions of its growth and health to the silk industry, might have been shown in such a way as to make the whole subject alive with human interest.

Certainly the silkworm, the honeybee, and the less spectacular, but nevertheless very important, earthworm from among the invertebrate forms should be approached and studied from the economic and human standpoint. So also should such deadly insect enemies of the human race as the bedbug, the “typhoid” housefly, and the “malarial” and “yellow fever” mosquitoes, to say nothing of stray dogs and cats, of rats and mice, and of the various animal parasites that spread disease so widely among the Chinese people.

As mere objects of study in a scheme of teaching a system of scientific biology, these forms of course have their place; but the fruitful starting point for the study of them by young people, in whom it is desired to arouse a permanent interest in science, should be found in their economic and human significance.

4. Physiology. This lesson was given later in another school by the teacher of the lesson just described. It was a much better performance. The subject was the anatomy of the bones. A skeleton and two good charts were used. The development was logical and clear. The discussion covered (1) the composition of bones, (2) the correlation of composition and growth with bone-building foods, (3) fractures and their treatment, and (4) the functions of the bones in relation to locomotion and other bodily activities,—especially the action of the bones as a stiffening framework, as levers, and for protection of the brain.
and spinal column. The subject was made very real and personal by correlating the movements of the teacher's fingers, wrist, arms, jaws, etc., with the structure of the bones, muscles, and tendons,—as shown with the skeleton, the charts, and his blackboard diagram. The teacher's language was simple and direct, and his demonstrations were attractive. He asked a number of questions, some of which were correctly answered, and others not.

This lesson was commendable for clearness, simplicity, logical order, and concreteness of illustrations.

One fault was the omission of the chemical experiments that are usually described in American textbooks for showing something of the composition of bone. Also, although there was some taking down of notes by students, this practice of note taking was not general and habitual. The making of careful notes should have been more generally and more thoroughly enforced.

Many other classes were visited; but not much of value would be brought out by commenting particularly on other lessons. The main points of interest brought out by observation are:

Summary of observations on other lessons.

1. The strong tendency of the teachers to do most of the talking, and permit the students to listen passively.

2. The tendency to depend wholly on oral instruction by the teacher and study of the textbook by the students, and to omit the use of abundant experiments, charts, pictures, specimens, lantern slides, etc., all of which are needed to make the subjects real and concrete to the pupils. Blackboard diagrams, which most of the teachers use freely, are not a substitute but only an accessory to apparatus, specimens, models, etc. Instruction must deal with real things. If it is wholly abstract it cannot be scientific.

3. Among those who use some concrete aids the tendency is not to use enough of them, or not to demonstrate them with sufficient thoroughness and exactitude.

4. More thought questions should be asked of the students; and a better technic of questioning is needed, as described in a preceding section.
As has already been stated, the teachers of this city were on the whole somewhat less subject to these faults than many of those seen elsewhere. Also, after the address on methods, a very marked tendency to use more and better questioning, to use more concrete materials and visual aids, and to take care that these should be seen and examined by every student was observed.

5. Laboratory instruction is absolutely essential in teaching the scientific method effectively; yet it is almost wholly absent in the normal and middle schools here.

One of the serious obstacles standing in the way of good teaching in several of the schools is the existence of very large class sections. Several sections numbering fifty or more students were observed. With such large sections it is very difficult indeed to carry on modern recitation methods efficiently. Some of the teachers mentioned this in the round-table conference, giving it as a reason why they found it difficult to use these methods. They said they recognized that the lecture method is inefficient, but with their large classes, they did not know how to use the recitation so as to get better results than by the lecture method. There is no question about the difficulty; and the only solution of it is to divide the classes into smaller sections, which in turn makes it necessary to increase the teaching hours per week for the teachers or to increase the number of teachers.

The American standard for high schools (middle schools) is an average of not more than twenty-five pupils per section and sections larger than thirty exist only under pressure of necessity where the school funds are inadequate.

In China, since the schools are generally under-financed and since tuition fees constitute a source of revenue, the temptation of admitting students to the point of overcrowding the sections is very strong.

Unless steps can be taken to limit the sections to proper size, the difficulty of using recitation and laboratory
methods will persist; and consequently the instruction will continue to be ineffective in giving real scientific training.

At present all that can be done is to urge the teachers to use all their ingenuity to provide opportunity for the students to recite and to make experiments themselves.

The teachers should make such opportunities on every one of the few occasions when it is possible. They should use to the utmost the meager equipment at their disposal, and should study to overcome the handicap of large classes by developing extra expertise and efficiency in questioning, and in training the students to answer quickly, concisely, and logically.

V. OBSERVATIONS IN CITY NUMBER 4

1. Physics. This teacher gave a straight lecture on some of the phenomena and principles of hydrostatics. He talked mostly logically but too fast. He made and explained three demonstration experiments. He held the attention of the students well; but he might have turned this passive attention into active attention, if he had asked the students some stimulating questions so as to direct observation and promote thinking. Instead, he told them everything; and left them nothing to think out for themselves.

One of his experiments was carried out successfully; but he missed an opportunity by having a servant assist him, instead of a student. This was the experiment of showing the relation of pressure to depth in a liquid by means of the streams of water which flow out from horizontal spouts at different depths.

In discussing this experiment he used the parallelogram of forces to explain the curves made by the outflowing stream; but he used only one parallelogram where he should have used at least three. Also he did not state
the fact, or show it in his parallelogram, that while the horizontal component of the distance traversed by the outflowing water in any one second is uniform and proportional to the square root of the depth, the vertical component of the same distance is due to the uniform acceleration of gravity, and is proportional to one less than twice the number of seconds during which the water has fallen. That is, \( s = \frac{1}{2}gt^2 \) \((2t - 1)\). This omission would lead the pupils to false or vague and indefinite conclusions. The explanation should have been correct, clear, and complete, otherwise it would have been far better to have omitted entirely this phase of the phenomenon.

His second experiment—that of Pascal's vases—was faulty from the standpoints both of manipulation and explanation. There are three parts of the experiment; and he omitted one of these, which was the one most important to the understanding of the principle to be explained. Also, in making the experiment (which is a difficult one to make successfully, and requires rehearsal and practice) he failed through lack of care and skill. He did not get the result which he should have got. When the apparatus is properly manipulated, in the cases of the wide-topped vessel and of the narrow-topped vessel, the water leaks out at the bottom just at the instant when it has been filled to exactly the same depth as that to which the straight-sided vessel was filled when the water began to leak out of it at the bottom.

Thus, because he got a different result in his experiments, the conclusion that he taught was directly contrary to that to which the students' observations from his experiments would naturally lead. If he had adjusted and manipulated the apparatus more carefully and skillfully, the phenomena that were observed by the students would have been in exact accordance with the theory. All science teachers should give very particular attention to eliminating such faults.
of teaching technic as the one just described; because when unskilled experiments are used to prove a conclusion that is directly contrary to the obvious implications of the phenomena that the students observe in the teacher’s experiment, the students must lose all respect either for facts or for scientific laws or for both. Either they will doubt the teacher’s competency or they will think that science is a system of cheating the senses.

Hence if a teacher fails in an experiment, he should explain the case of the failure and repeat the experiment with sufficient care to avoid the cause of failure and get exactly the right result.

There is only one way for teachers to avoid such unfortunate and pedagogically vicious situations as a failure in an experiment invariably begets; and that is to rehearse and practice every experiment until it is certain to work out correctly and convincingly when it is made before the class.

The third experiment made by the teacher was also not made with sufficient care and skill.

It was the experiment to show that the upward pressure of a liquid at any given depth is equal to the downward pressure. An open glass cylinder with a thin circular plate of glass covering the lower end is pushed into a vessel of water. The loose plate is held up against the cylinder by the upward pressure of the water in the vessel; but when water is carefully poured into the cylinder till the level of the water inside is just the same as that of the water outside, the false bottom of the cylinder falls off and sinks. In making the experiment, the teacher poured the water in so rapidly that the students, when the false bottom fell off, could not see whether or not the water was at the same level inside and outside. The teacher should have used colored water to pour inside the cylinder; and at the last, when the level inside
the cylinder was just a little less than that outside, he should have poured the colored water in very slowly. At the same time he should have cautioned the students to watch carefully, both the false bottom and the level of the colored water. By thus coloring the water and pouring it in very slowly he would have made sure that the students should observe the essential facts in the case. The conclusion from the observed facts would then have been obvious and unescapable.

These experiments have been described at length because they show clearly some of the bad effects that grow out of the practice of doing experiments in a superficial and careless way. This is a practice that works directly against the inculcation of the scientific spirit and attitude of mind. It is a practice which in greater or less degree is almost universal among the teachers in the schools of North China. Hence the discussion above, which is intended to make clear to the teachers the harmful effects of superficial and unpractical experiments, and to point out suggestively the ways in which an improved technic may be acquired.

This teacher is to be commended for making more experiments than are usually made, and for an interesting presentation of the subject in logical order; but he could easily improve his teaching by three hundred per cent if he would put more care and skill into his experimenting, would get his students to assist, and would use well distributed questions to make the students participate and think, instead of doing all the talking himself. There are many of the Chinese teachers who, like this one, might become teachers of outstanding excellence if they would study more carefully how they might improve their technic along the lines suggested by the foregoing discussion.

2. Chemistry. This teacher was giving a lesson on the gas laws of Charles and Gay Lussac, and of Boyle. Demonstration at the lecture table of the former law is not easy; and most teachers do not attempt it, unless
they have a special apparatus designed for the purpose. It is ordinarily used for an advanced laboratory experiment. This teacher did not make the experiment, nor describe with a diagram the manner in which it is performed. He explained the law and developed the two different forms of the equation by which it is customarily stated in mathematical terms. He then proceeded to show how the equation is used to solve numerical problems. He worked out two or three such examples on the blackboard; but these were exactly the same ones used in the textbook. *In fact, his presentation was a copy of the substance and order of presentation of the same subject in the textbooks which lay open before the pupils. There was no addition or omission and no variation.*

He should have given the students some examples of the same sort to work, instead of working them all himself; and the examples given should be different from those in the textbook. He should also have shown how the law must be used in chemistry when gas volumes are measured.

He next began the explanation of Boyle’s law, with the usual form of hook-shaped tube, and mercury. To start this experiment the operator should first pour in a small amount of mercury, then lay the tube nearly horizontal on the table, and slightly tilt it so as to raise one side of the bend a very little above the other side. Then he should gently tap the tube until a small bubble of air passes from the lower side to the higher side. He should continue to pass small bubbles of air in this manner from one arm of the tube to the other, until, when the tube is stood up vertically, the mercury is at exactly the same level on both sides of the bend. It is absolutely essential to start the experiment in this way with the mercury at the same height in both arms of the tube. Otherwise the method of reasoning by which
the law is ordinarily deduced from the observations cannot be in accord with the facts as they are observed.

Also in this experiment it is necessary to read a barometer to determine the amount of the atmospheric pressure. This pressure does not always equal that of a column of mercury seventy-six centimeters high, but varies from place to place and from day to day, and often from hour to hour. Hence the only way to find out its actual amount at any place and time is to read an accurate barometer at that place and time.

Now this teacher started the experiment with the mercury at different levels in the two arms of the tube, and did not read the barometer. Yet in his explanation, he assumed and stated that the pressure on the confined air in the short arm of the tube was equal to that of the atmosphere, which it could not be unless the mercury in both arms was at the same level. Also he assumed and stated that the pressure of the atmosphere was equal to that of seventy-six centimeters of mercury, although he had not read a barometer, and therefore could not possibly have had any idea what the atmospheric pressure really was. The chances are over one hundred to one that it was not seventy-six centimeters, as he assumed it to be; for this is the average pressure at sea level. He then poured in mercury till the volume of confined air in the tube was half what it was before, and told the pupils that the volume was now one half and the pressure just two times that of the atmosphere. Under the circumstances the new pressure could not possibly be two times the atmospheric pressure, but would have to be more than that. Also in the first case the pressure on the confined gas could not have been equal to that of the atmosphere as he had said it was, but was greater than that, because at the beginning of the experiment the mercury was higher in the open arm than it was in the closed arm.
Finally, in the second case, the pressure on the confined gas in the short arm could not possibly have been two times seventy-six centimeters, as he said it was, unless it happened so by a very improbable coincidence.

If he had allowed the students themselves to make readings of the barometer and of the heights of the mercury columns in the two arms of the tube in both cases, and if the students had made correct readings and calculations, they would have found that none of the statements that he had made was true. Also if they had reasoned correctly as well as observed correctly, starting with his first (false) assumption, they would have reached the conclusion that Boyle's law is not a statement of fact! Perhaps it was fortunate that the teacher made the additional pedagogical mistake of not having the pupils take these readings for themselves; for if they had done so, and had not become completely bewildered by this combination of logical inconsistencies, they would certainly have lost faith either in the teacher's statements, or in the laws of science, or in both.

Now I wish to say emphatically that this case has not been cited in order to hold up this teacher for ridicule or even to condemn him as incompetent. Quite to the contrary, it has been cited, as the preceding one was, for the sole purpose of pointing out to these teachers, and to all others, specific examples of the kinds of errors which they should study hard to avoid.

In the case of the latter experiment I have observed exactly the same erroneous procedure carried out by two other teachers in two other cities. Such cases are not accidental or unusual. They are typical of what has been frequently observed.

We must not attach too much blame to the teachers themselves. The fault lies not so much with them as with the way in which they have been trained. Evidently their education in science has not been such as to train them properly in the methods and the logic of science. All of them have
institutes and summer courses in colleges and normal schools. been taught mostly, and most of them wholly, by lecture and textbook methods similar to those they are using. They have had very little or no training in the art of careful experimenting, and in careful, close reasoning from observed facts to logically valid conclusions. They have had no correct and faultless examples of scientific experimenting and teaching to use as standards against which they might measure their own teaching performances.

The teachers now at work can do much to improve, if they will prepare themselves more carefully, lesson by lesson, for presenting the experiments and carrying out the appropriate steps in instruction accurately and logically. Especially should they study, earnestly and industryously, good textbooks in their sciences, and the best modern treatises on the teaching of their sciences.

The real and permanent remedy, however, lies with the teachers in the colleges and higher normal schools who are training the new generation of teachers for work in the middle schools. On the college and higher normal school professors lies the responsibility for the future of science and science instruction in China. They must do their own teaching in such a way as to train their students to accuracy and correctness in experimenting, in reasoning, and in teaching. If the science teachers of ten years' hence shall be making the same errors that are being made so widely and frequently by the science teachers of to-day, the responsibility for their unscientific and injurious teaching must be laid upon the shoulders of those who now are teaching the sciences in the colleges and higher normal schools. Let them take heed of this and consider carefully their methods of instruction.

3. Physics. This teacher was giving a lesson over the same ground as that described under 1. He used a
combination of lecturing and questioning. The development of the subject was logical and straightforward. He carried through the experiment of Pascal’s vases, using all three of the different-shaped vessels. He presented the three cases in the simplest logical order. His manipulation was not perfect; but was near enough so to be fairly convincing. (This experiment is difficult; and in my own experience I have always found it necessary to practice it several times just before presenting it to a class in order to renew my skill. Otherwise I could not be sure that it would work perfectly before the class and thus carry absolute conviction to their minds.)

The teacher’s explanation of the “hydrostatic paradox,” which accompanied and interpreted the experiment, was very good indeed.

The attention and interest of the students were good.

The teacher drew diagrams of two other forms of apparatus for showing that the pressure within a liquid is equal in all directions, and that the pressure within the liquid due to its own weight is proportional to the depth. These experiments themselves are simple; and the forms of apparatus described are easy to make if one does not have them already provided; but in this case the experiments were only described and not carried out. This is a very common fault — namely, omitting important and significant experiments which would be quite easy to make if a little time were given up to preparing the apparatus for them.

On the whole, in spite of the omission of these experiments, the lesson was a superior one in comparison with most of the physics lessons thus far observed in China.

4. Physiology. Review lesson on the anatomy of the head, the nose, and the throat. A running lecture with frequent questioning. Development logical. Structure closely connected with function at every point. Uses charts and blackboard diagrams, which he draws quickly
and well. He works out on the blackboard a complete outline and classification of terms. His questions are long—perhaps longer than necessary, and the students answer in volleys. Their answers are short. The questions tend to suggest the answers, which are mostly of the memory sort only. About ten per cent of the students answer.

A lesson given by this same teacher in another school was similar to this one, but rather superior to it in quality and results. More illustrative materials were used. Shorter and better questions were asked, and better responses received. The teacher is experienced, and knows his subject very well. Excepting for the infrequency of his thought questions, his habit of permitting volley answers to thought questions, and his failure to distribute his questions so as to bring the laggards into activity he would be rated anywhere as a superior teacher. However, like all but a very, very few of the teachers of biology in schools of middle grade, his work lacks completeness also from the fact that he does not use individual laboratory work of any sort in his instruction.

It cannot be said too often or too emphatically that science teaching without at least some individual laboratory practice by the students, is inadequate for producing real and thorough scientific training.

5. Physics. This teacher was giving a lecture on wireless telegraphy. No apparatus of any sort whatever was used. Blackboard diagrams made by the teacher were very poor. They lacked clearness almost to the point of being entirely unintelligible. Explanations were disconnected and lacking in logical sequence. No questions were asked. The students were passive and apparently bored.
6. Algebra. Contrasted with the lesson just cited there was one in algebra by a teacher in the same school. The lesson was on the method of solving quadratics of the form $ax^2 + bx + c = 0$ by the method of factoring. The method was presented by a strictly inductive approach, using numerous examples with all sorts of variations in coefficients and signs. The students were shown how to determine the coefficients and signs of the terms of binomial factors by a systematic analysis according to a uniform plan. They were being trained skillfully to use this analytical method of attack instead of guessing and testing at random as so many algebra teachers allow their students to do. By frequent questioning the teacher drew the students into participation, making them rapidly suggest, criticize, and select. The teacher’s exposition work was really excellent; but his method could have been very much improved by giving out to the students practice examples to be worked rapidly on paper at their seats and at the blackboard in accordance with the method he was teaching them. Such work at the blackboard should be criticized and checked by the pupils at their seats; and the examples worked on paper should be exchanged by the students to be checked and returned. Mistakes and difficulties should be analyzed and cleared up by rapid discussion. With the addition of such work, this would have been an example of the highest excellence in the teaching of this type of algebra work.

Comments on this lesson afford an appropriate occasion for a criticism which applies to practically every government and provincial school yet visited and to many of the mission schools. This is the lack almost everywhere of adequate blackboard space.

With a few notable exceptions, mostly among the newer buildings of the missionary colleges and middle
schools, the blackboards cover only from six to twenty linear feet, and are of very poor quality. Hence in most of the schools it is impossible to use the very valuable method of sending the whole or a half or a third of the class to the blackboard at one time. At the blackboard, American students work out problems, review outlines, and diagrams, and other exercises, in the various subjects. They explain these to their classmates. These are checked up, criticized, and discussed by the class and teacher. This valuable type of instruction is denied to the students of China, but it should be denied them no longer. School authorities everywhere should endeavor to make good this deficiency in blackboards as thoroughly and as speedily as possible. In my opinion the best material for blackboards in China, when cost, quality, and durability are jointly considered, is the so-called Beaver-board, which is a composition of wood fiber with other materials. When properly mounted, this is the next best thing to Number 1 American blackboard slate, which is the best material of all, but much more costly than Beaver-board.

7. Physiology. This teacher is a young man of remarkable force and charm of personality. He is a born teacher. His presentation is clear, definite, and logical; and his delivery magnetic to the point of eloquence. The students scarcely took their eyes from him during the hour; and the same was true of the half dozen persons, including the writer, who were visiting the class. The boys paid no attention to us, and hardly seemed to know that we were present.

The lesson was a review, consisting partly of exposition, but mainly of reviewing facts of anatomy and physiology and their relations to one another, especially the relations of structure to function and of physiology to hygiene. As the facts were reviewed they were reorganized into a well constructed outline.
The instruction was carried on at a rapid-fire rate, and consisted of questioning and explaining in about equal amounts. The students answered promptly; nearly all of them participated and seemed very well prepared. The teacher used blackboard drawings and charts. His drawings were very good, and were made with wonderful rapidity.

This was a lesson that would have drawn admiration from the most exacting critic. Only one feature of the work would seem to call for criticism. This was the practice of addressing thought questions to the class instead of to individuals, with the result that the various answers blended in a volley of noises from which it was difficult to single out any particular answer and get a check on its accuracy.

A thought question should be stated first; and after a brief time for reflection by all the students a single individual should be called on to answer it.

8. Mineralogy. This was a laboratory lesson in crystallography, conducted by the same teacher who gave the lesson just previously described. The school has no laboratory; but the students worked individually and in pairs at the desks in the classroom. They were working on models of crystals, locating the axes and describing and classifying the forms. Lively but quiet and businesslike discussions and arguments were going on between individuals within the several groups. Every now and then a group would go to the teacher, when they could not agree on some point, or were blocked by some difficulty; and he would direct them in such a manner that they were able to agree on the correct conclusion. He rarely answered their questions directly, but almost always so as to make them find out for themselves. This was an excellent lesson; but it might have been better still if the pupils had made notes and drawings in their notebooks, in order to systematize and fix in mind the results of their observations.
9. A number of other lessons might be described; but they were much alike, though in various subjects. They consisted of nothing but straight lecturing by the teacher, without the use of any apparatus, maps, charts, or other visual aids such as should be used. In these lessons neither teacher nor students asked any questions; and the interest and attention of the students was of course not very great. In most of these cases the teachers presented the facts concisely and in logical order, and used the blackboard to sum up the ideas and write mathematical solutions or chemical equations, etc. Very few of these lessons were really poor from the standpoint of exposition and logic; but they lacked the vitality of touch with real things, and they failed utterly in getting any vital responses of self-activity from the pupils.

Teachers should be judged by the reactions of their pupils.

Teachers should get the idea that their teaching success must be judged not by what they themselves do, but by what kind of learning responses their acts elicit from their pupils.

VI. ILLUSTRATIONS FROM CITY NUMBER 5

It is quite evident that many of the teachers here have much more than average teaching ability and skill, that they are wide-awake to opportunities for improving their instruction, and that they are open-minded and ready to grasp and carry out suggestions for the use of better and more modern methods of teaching.

This is proved by the fact that several of them who attended the lecture given for their benefit during the early part of our visit in the city adopted and used successfully many of the practical suggestions that were made during the lecture.

The teachers are open-minded and are interested in improving their methods.

The result was that their methods of instruction, which had been notably good, showed great and easily perceptible improvement with respect to several points of technic to
which their attention had been directed. The effect of these improved methods on their pupils was evident; for the pupils showed unusual interest and attention and displayed much initiative. They showed that they were as anxious to participate in the recitations as Western students are, and that they could contribute successfully to the discussion of the questions under consideration. These results show conclusively that there is no real ground for the statement frequently made by Chinese teachers, that Chinese students resent being questioned, and do not like to participate in recitation work.

It proves that they do like to participate in discussions, and to ask and answer questions, when their interests are appealed to by good methods of instruction.

The following citations from notes taken during classroom observation will serve to describe some of the best teaching that was witnessed:

1. Mineralogy (a college class). The teacher is a graduate of Peiyang University in Tientsin. This is a college class and he teaches in English. His English is good; but not so good but that probably his instruction would have been much more effective if given in Chinese. The method was by lecture, with rapid-fire questions and comments on the students' answers. These answers by the students were promptly given and usually correct; but participation by the students was not general.

A very good college lesson.

The answers came apparently from about a third part of the students; but all paid excellent attention, and appeared to be thoroughly interested.

It would have been better to call on some of the silent students by name; but this should not have been allowed to take too much time. It would have broken the continuity of interest and slackened the attention of the pupils.

The teacher used skeleton wire models of crystals as types, and compared the solid wooden models of the
different varieties with the types from which these variant forms are derived. The types and their variants were explained deliberately in clear logical order, attention being directed constantly toward the appropriate models. At each important point a question was asked to determine whether the principle had been grasped by the students. As each type form was explained, the corresponding models were placed in line on the lecture table, so that the arrangement of the models demonstrated the principles of the classification. Then some real crystals of the various types were shown. This was a really good lesson; and if followed up by laboratory practice with models and specimens for the purpose of getting the students to apply the principles and fix them in mind by reviewing observations and questions, it would represent an excellent system of teaching. Laboratory practice should include the making of a few wire and paper models by each student, and also the study of numerous natural crystals in which these were to be compared with the type models. The textbook used in this class is a standard text in English and it is supplemented with lithographed notes compiled by the teacher.

2. **Physics.** (This was a class in the preparatory year of the Agricultural College.) The teacher is a graduate in mechanical engineering and is author of a textbook on mechanism. The lesson was on the elementary mechanical devices (wheel and axle, pulley and screw, and their variants, such as the windlass, capstan, and differential wheel and axle).

The teacher had the models ranged in order on the demonstration table, and took up the forms in turn. He first explained the characteristic properties of each apparatus, then had the students come forward in groups and examine it carefully, directing their attention to the essential features. He then made front and side-view diagrams on the blackboard and developed the theory and the static and dynamic equations (the moment equation and the work equation). He then showed how
the former equation can be derived from the latter, so either equation may be used to solve practical problems, according to which equation is more conveniently applicable. Having developed and correlated the two equations he proceeded to show how they are to be applied in working practical problems. During the working out of the sample problems he called on students at various times to suggest the next step. He should then have given out a list of similar problems for the students to solve outside the class and report,—perhaps having them first solve two or three in his presence, to see that they comprehended the process fully. The procedure with the other models was similar; and the entire lesson was well carried out. The lesson was given in Chinese. The text was a lithographed pamphlet prepared by the teacher.

As a lecture demonstration this was an unusually good performance. It would have been better, however, to have confined the lecture work to the explanation of the most difficult parts and to have developed the remainder by the recitation method. For this the students should make previous preparation by study of the textbook and lecture notes; and pupils should be sent to the blackboard to work out equations, solve problems, and explain these to the class. The class should criticize and discuss the explanations as they are made.

After the lecture the teacher invited the students to ask questions, but they did not ask any. He should have told them that if they did not ask some questions he would. He should then have followed this up with some lively cross-examination questions to test their comprehension.

3. Chemistry (a middle school class). This was a combined lecture and recitation, in which explanation by the teacher was alternated with rapid-fire questions asked also by him. The students gave excellent attention. They usually answered questions promptly and for the
most part intelligently. They frequently set down notes in their notebooks. The lecture was on the chemical properties of chlorine and the chlorides and especially on the formation of nascent chlorine in aqua regia; and its energetic reactions. The development was logical; and special attention was paid to the grouping of reactions according to type forms. At each step in the development, questions were asked to test whether the students had comprehended the previous step. His questions were well distributed throughout the class so that all paid close attention. When he showed an experiment, he was careful to see that the necessary observations were made by each pupil. He called the pupils to the lecture table so that they might see better.

The test used in this class is the Chinese text authorized by the government for middle schools. The teaching was entirely in Chinese. This was a very good lesson, and was evidently effective. The students in this class appeared to be quite at home with chemical ideas.

4. Zoölogy (a middle school class). This teacher is a graduate of the Paoting Higher Normal School. He gave a straightforward lecture for part of the hour and during the rest of the time passed specimens, asked questions, and gave supplementary explanations. The students made notes and sketches. Instruction was in Chinese. He took care that the specimens were passed, so that all might see them. This was a fair lesson, but would have been much better if the questions asked had been more logical and consecutive, and if thought questions had been more frequent than mere memory questions.

5. Later in the week several lessons were observed in which the teaching technic was greatly improved. Care was used to see that a more complete assortment of apparatus, specimens, charts, skeletons, or other visual aids were on hand; and the attention of the students was carefully drawn to these. More care was
used to make sure that every student should see and even handle the specimens shown. More careful correlation was made between the real objects and the charts or blackboard diagram by which they were represented. More thought questions were asked and these were better distributed. More care was taken to speak slowly and distinctly, and to mention practical applications and connect up the teaching with everyday life. These improvements by the teachers in their technic made under the stimulus of our visit were very encouraging in connection with the study of the educational situation, because they show how easy it is for the Chinese teachers to make immediate improvement when they become interested in doing so.
CHAPTER 17

VITALIZED CURRICULUMS

I. EDUCATIONAL OBJECTIVES

The main objectives of secondary education have been variously stated; but no authoritative statement thus far made seems as nearly applicable to Chinese conditions or as likely to be well understood in China as that made by the American National Commission on the Reorganization of Secondary Education, whose reports\(^1\) are published by the U. S. Bureau of Education at Washington, D. C.

This Commission stated the objectives as follows:

2. Command of fundamental processes.
3. Worthy home membership.
4. Vocational efficiency.
5. Efficient citizenship.
6. Profitable enjoyment of leisure time.
7. Ethical character.

If education were universally available, and if it were to secure these objectives in large measure to each individual educated, no one can doubt that the result would be a speedy and rapid advance all over the country in peace, prosperity, and general welfare. The present curriculums of the secondary schools of China, which are substantially the same in all the provinces, are lacking in some important elements that are necessary in order to realize these objectives.

Health education is fairly well provided for by a course in physiology and hygiene, by fairly efficient physical training and athletic sports, and by some attention to hygienic habits of living. All these means, however, might be much improved by better planning, more thoroughness, and more scientific methods of instruction; and they ought to be.

Command of the fundamental processes of reading and writing Chinese is provided for by what seems to me to be a too generous apportionment of time. The same may be said of English, which, though it is a foreign language, is almost a necessity for every individual who is to work in a field of endeavor where scientific knowledge and Western methods of doing things are factors in efficiency. It is the language through which the widest contacts with Western achievements can most easily be gained.

This is assumed in the curriculum; but more time is allowed to both Chinese and English than seems advisable or would be necessary if the selection of Chinese were more careful and discriminating, and if the methods of teaching both Chinese and English were more efficient. Speaking Chinese and speaking English correctly, as well as reading and writing them, are fundamental processes for which the methods of teaching make practically no provision, and for which no special opportunities are provided in the time schedule.

Mathematics, especially arithmetic, includes processes that are essential in everyday affairs, and these should find a place in the secondary curriculum unless the students have already mastered them in the elementary schools. Furthermore, algebra and geometry are fundamental in the higher scientific vocations. These are included in the curriculums; but the custom of teaching them by lectures does not give command of the processes so that the students can make practical use of them.

None of the curriculums seem to afford any training or information that tends to fit the students to become worthy
and efficient heads of families; little if any provision is made for instruction in the essentials of good citizenship; and little provision of an effective nature seems to be made for training in ethical character.

Harmless enjoyment during hours of leisure is provided for by training in athletic sports; but it is not provided for as extensively as is desirable by the development of tastes and appreciations in the fields of good literature, art, music, and nature study in the field.

Large provision for vocational efficiency is made in the special technical, agricultural, and vocational schools. The other schools have very little in them that contributes directly towards vocational efficiency. The normal schools, for example, which on the vocational side ought to be giving much of their instruction in such subjects and by such methods that it would result directly in skill in the art of teaching elementary school work, are giving almost nothing that a beginner can use in teaching young children.

So, also, the commercial schools are giving very little instruction that will help their students to become efficient modern business men.

The middle school curriculum usually consists, for each year, of six hours a week of Chinese; eight of English; four of mathematics; two to four of science; and very little of geography, history, civics, art, manual training, or (for girls) household arts. The subjects included in the curriculum are taught in a purely formal way by lectures and from textbooks, with the students nearly always in a passive attitude. "No impression without expression" or "No learning without doing" are universally accepted principles of education; yet only in rare cases were students found to be making any reactions at all, or expressing their own thoughts in any way.

In order to attain the objectives mentioned, another essential is to develop, in the students, ability to think for themselves in the face of problematic situations. The method of lecturing exclusively does not do this.
II. NEW CURRICULUMS RECOMMENDED

In view of these facts, and in response to many requests from teachers and commissioners of education, I have therefore given this discussion of the objectives, which I recommend for adoption. In order that there may be more possibilities for attaining these objectives, I recommend a complete reconstruction of the curriculums. To serve as a practical guide for such reconstruction, tabulated outlines of various curriculums suited to the needs of the various groups of Chinese students are here presented. They are so planned as to provide more comprehensively and also more intensively, for attaining the objectives that are recommended for adoption. In each of these curriculums the amounts of time to be given to Chinese and to English are reduced; and the program of studies is enriched by the introduction of more of the social studies and of opportunities for instruction in art and manual training. It is expected that the teaching will be done largely by laboratory and recitation methods, in order that thinking ability may be developed.

These curriculums, each of which is planned to meet the needs of a special group of students, are presented serially below. All of them are planned for a six-year high school course beginning with the seventh grade and ending with the twelfth. Any of them may be used either with the 6–6 type of organization or the 6–2–4 or the 6–3–3. The required intellectual work in each year is represented by twenty class periods a week. An additional requirement is made of five periods a week to be devoted wholly to athletic games and physical training, or three fifths to athletics and physical training and two fifths to manual training.

The great advantage of these curriculums is that they provide for long-continued effort in several fields of learning, yet give opportunity for acquaintance
with a rich variety of studies, each of which is chosen for its real significance in attaining one or more of the various objectives of education that have been set forth and recommended.

### III. The General Curriculum

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Chinese Reading, Composition,</td>
<td>Literature and</td>
</tr>
<tr>
<td>Literature, History</td>
<td>Composition 5</td>
</tr>
<tr>
<td>English Language, Reading,</td>
<td>5</td>
</tr>
<tr>
<td>Composition (Oral and Written)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>Junior High School Mathematics 5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Science</td>
<td>General Science 3</td>
</tr>
<tr>
<td></td>
<td>Community Civics 2</td>
</tr>
<tr>
<td>Social Studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletic Games and Physical Training</td>
<td>3</td>
</tr>
<tr>
<td>Manual Training</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
</tr>
</tbody>
</table>

Art may be elected up to a total of three additional periods a week in any grade.
The General Curriculum is planned for the purpose of giving a thorough and comprehensive preparation for entrance to colleges, higher normal schools, higher technical schools, or universities. The name “general” rather than “college preparatory” has been given it to avoid attaching to it an air of superiority or snobbishness which is apt to go with the latter name, and which gives rise to a tendency of students towards feeling that the other curriculums are inferior in quality and are to be looked down upon.

In this curriculum a sequence in Chinese of five periods a week for a year in each of grades 7 to 10 inclusive, or four units in the first four years, is provided. In the fifth year (grade 11) it appears for three periods a week. That is, three fifths of a unit is provided in grade 11 and two fifths of a unit in grade 12, making a total of five units in the six years. The loss of one unit out of the six-year sequence can be compensated for by requiring library reference reading and oral and written composition work in Chinese in connection with the study of modern history and Chinese history. This correlation will give an added significance to both the history and the Chinese language.

In English, one unit of five periods a week is required in each grade excepting grade 11, in which two fifths of a unit is required, and in grade 12, in which the requirement is three fifths of a unit. This loss of one unit out of the six-year sequence may be compensated for by composition work in English based on the class work and collateral reading in the study of modern world history, and also by requiring some recitation and written work in English in connection with the geometry, physics, or chemistry classes, and especially in composition and debate in connection with problems of democracy.

The importance of English for all students who are preparing for college or for business life in China can scarcely be overestimated. It is, and for some time will
be, the common language of scholars in China, excepting in the fields of Chinese literature and history, and even in those fields to a considerable extent, as where modern methods of historical and literary research are involved. Also English is, and probably always will be, the language most commonly used by Chinese in carrying on commerce and industries in association with foreigners.

For college students at present and for a long time to come, English will be necessary because of the lack of suitable text and reference books in Chinese, and because this lack is most commonly supplied by English and American books. Of course, a good case might be made out for German, French, Italian, or Japanese on a similar basis; but it would be unwise in general to induce students to spend the disproportionate amount of time on foreign languages that would be necessary to learn two or three. As among these languages mentioned, it is quite clear that China has already made her choice in favor of English. There are among the various provinces quite a number of schools in which the medium of instruction is either German, or French and Japanese, instead of English; and it is well that these exist, since China ought to have some scientists and technicians who can think, speak, read, and write in these languages.

The English sequence should start with the natural or conversational method of learning, with no translation or at most very, very little. The objective should be, first, to build up a working vocabulary by teaching the students to speak, to hear and understand, to read, and to write a few new words every day, and fix them in memory by repeated use in conversation and writing. Very little formal grammar should be taught, and that only as needed for correct speech, as sentence after sentence is learned. The little grammar that need be taught can best be taught inductively. After a working class vocabulary has been built up, there should be much
reading, explaining, and telling of simple stories from biography, history, and geography, and much conversation about them, but no translation. After two years of such work, the reading of complete English classics and short stories may begin. Many of these should be read individually and silently by the students outside the classroom, and explained, retold, or discussed in the classroom.

Gradually, the essential principle of grammar and rhetoric should be brought in; and their observance should be enforced in connection with all the recitations and all the oral and written compositions of the students.

There should be much reading and discussion of English and American periodicals and newspapers as well as the best short stories and essays, some of the best and most understandable poetry, and some science or nature study readers. Nothing serves so well to build up a large vocabulary as does much reading, conversation, and writing. For this purpose grammatical study and rhetorical analysis are of very little use.

The teachers of English should be masters of the language. The fact that in the Chinese public schools the teachers of English themselves usually have a very imperfect knowledge of English is sufficient to account for the poor results that usually are obtained from the teaching of English.

The mathematics sequence provides for five units—that is, for five periods a week during each of the five years spent in grades 7 to 11. The first two units should be mainly practical arithmetic, combined and correlated with the simplest and most fundamental principles of algebra and concrete geometry. Such courses are already formulated in textbooks in America under the name of junior high school mathematics.

For the two years next following (grades 9 and 10), I recommend either that algebra and plane geometry be carried out together as a single correlated course
like that represented in the textbooks of Breslich of the University of Chicago High School, or that they be taught as two interlocking courses on alternate days of the week. With either of these plans the essentials of algebra through quadratics and the essentials of plane geometry should be satisfactorily completed by the end of the fourth year, or grade 10.

In grade 11 the elementary algebra may be completed and solid geometry may be covered, either as two interlocking courses, given on alternate days of the week, or as a single correlated course running five days a week. *The teaching of mathematics should never be by lecture, as is now customary almost everywhere in China.* The instruction should all be a combination of recitations and laboratory work by the students, supplemented with class explanations and individual help by the teacher when these are needed. In general, with a good textbook in their hands, with study and preparation, and with an abundance of supplementary problems carefully selected and graded by the teacher, the students should do the most of the work without much assistance. Nearly all the explanations and proofs should be given orally or written out by the students themselves. *The teacher is useful not as chief performer, but as stimulator, adviser, director, and helper.*

What is here meant by laboratory work in mathematics is practically the same as supervised study when the students are simply working out calculations, problems, and proofs; but it becomes more like laboratory experimentation when they are making graphs and geometrical constructions with the use of drawing instruments, or when they are making models of wood, pasteboard, bamboo, or wire in connection with the study of propositions and problems in plane and solid geometry. This type of laboratory work in mathematics has many advantages, not the least of which is that it is well adapted for adjustment to individual difference in the
students. Each student may work as fast as he is able; so the very bright students may complete the course in a shorter time; or if this is not thought desirable, the bright students may be given more work, or more difficult work, while the slowest may be given the minimum that is required for the passing of the course.

The two main objectives to be sought in the learning of mathematics are (1) skill in its use as a tool or instrument for economy in thought and calculation, and (2) as training to acquire skill in logical thinking.

The natural science sequence consists of two years of general science three periods a week, one year of civic biology three periods a week, one year of general geography five periods a week, and two years of physics and chemistry. There are some very distinct advantages in carrying the physics and chemistry along together as two interlocking courses on alternate days of the week; but if this arrangement causes too serious difficulties in scheduling double laboratory periods, it may prove better to give only physics in grade 11 and only chemistry in grade 12.

Besides its intrinsic value as information and skill, the study of natural science is *par excellence* the means of training in thinking and investigation, for the solution of great human problems.

Since the great importance to China of thorough and widespread knowledge of science and the scientific method of problem solving is admitted on all hands, it is not necessary to argue in justification of this six-year sequence of science studies. Some explanation, however, may be necessary to an understanding of the names given to the courses of the first four years.

"Introductory science," or "general science" as it is frequently called, stands between the informal "nature study lessons" which should be given throughout the first six grades (and even in the kindergarten) on the
one hand, and the more systematically organized courses in the special sciences, such as physics, chemistry, and biology, on the other hand. The distinctive feature of "introductory science" is that the course is to consist of a series of simple and interesting scientific problems that arise in the everyday life of the pupil or his family or his community, and that require, for their understanding and solution, information drawn from the various special sciences.

This information is organized about the problems themselves; and for any given problem, the information is selected purely with regard to its bearings on the solution. The problem itself is the center of interest and organization; and there is no attempt to get a connected and comprehensive view of the facts and principles of any one science. This latter will come later in the senior middle school or the college.

This choice of a psychological rather than a "logical" plan of presenting the elements of science in an introductory course is thought to be far superior to the plan now in vogue in the middle schools. According to the curriculums now in use there are brief and very formal presentations of courses in systematic mineralogy, physiology, botany, and zoology two hours a week for a half year each in grades 9 and 10 and four hours a week of physics and chemistry in grades 11 and 12.

Two suitable textbooks for "introductory science" are to be obtained in Chinese, one published by the Commercial Press and the other by the Edward Evans Company, both of Shanghai. These may be used as guides; but the teacher should adapt the instruction and materials to local conditions and thus improve upon the textbook to the full extent that he is able to do so.

"Civic biology" is the name given to a series of studies from the fields of physiology and hygiene, zoology, botany, forestry, agriculture, horticulture, and general biology, in which the facts and principles and forms of biology that are
studied are those which are most nearly and obviously related to the health, prosperity, and welfare of mankind. The studies of special interest in this subject are related to those biological problems whose solutions depend upon civic, provincial, and national coöperation. These are such as stamping out contagious diseases, extermination of harmful insects, conservation of forests and bird life, improvement of crops and live stock, afforestation, flood prevention, and the like. The proposition to substitute such a live and interesting subject, and a subject so vital to China, for the formal courses in zoölogy and botany that are now given, should need no defense. The superiority of this new type of biological instruction ought to be nearly self-evident.

"General geography" is the term used to designate a course beginning with the fundamentals of physical geography as a foundation, building on that a study of the principal physiographic regions of the home country and some of the foreign countries most closely related to it, and following with the main principles of politico-economic geography (that is, of the geographical conditions and relations that are vitally related to the economic and political development of the various important countries).

This is the type of geography that is coming more and more to be taught in American and British schools. It is displacing "physiography," which was found to be less closely related to everyday life, or "commercial geography," which was too much a mere catalogue of dry facts, with no interesting and instructive causal relations to connect them and make them significant to the student.

Since China is becoming more and more concerned with the development of her own territory and natural resources, and since also she is coming into more and more intimate relations with other nations, the urgent need for more and better geographical knowledge to be possessed by her leaders should be apparent. General
geography, therefore, has been placed as a required subject in every one of the curriculums recommended, excepting in the general curriculum. In this curriculum it is made optional with ancient and medieval history.

This option is recommended, because there is as yet no adequate textbook in Chinese for general geography, and there are as yet so few teachers who are prepared to teach it. However, general geography is much more significant to students than ancient and medieval history and is much more intrinsically valuable in dealing with modern conditions and affairs. It is therefore advised that steps be taken as early as possible to introduce this subject as a requirement in all schools of middle grade, and that an insistent demand be made on the colleges for courses that will prepare teachers for teaching it. A good textbook from the Chinese standpoint, and in the Chinese language, is urgently and immediately needed. Who will write it?

No special comment is needed with reference to physics and chemistry, excepting that immediate steps should be taken to have laboratories equipped for individual experimentation by students under the supervision of the teachers, and that the system of exclusive lecturing be replaced by a combination of instruction in the laboratory with recitations and conferences in the classroom in which every student is required to prepare himself to take part. *Lectures should occupy at the very most not more than one fifth of the time.* One double period a week should be given to laboratory instruction. Laboratory work to the amount of one single, or, better, one double, period a week should also be required in the other subjects of science just as early as it is possible to provide laboratory accommodations and equipments for them.

The sequence of social studies also requires some explanations on account of the presence of new ideas and new names. Community civics is a study of the
coöperative activities of the home community and local
government, of the projects carried on coöperatively
by bodies or groups of citizens for the promotion of public
health, law and order, and the general welfare, of the
relations of the individual to the home, to the local
and provincial activities, government and laws, and of
the duties and obligations, as well as rights, of citizen-
ship. The characteristic feature that distinguishes this
type of course from the courses formerly
given in "civil government" or "civics"
in America is that the students themselves
carry on observations and investigations concerning
community conditions and activities, and study com-
unity activities and projects rather than the mere
political machinery, or mechanical processes and offi-
cials, by means of which the government carries on
and performs its functions. Community civics is a
great subject for impressing young students with their
civic obligations, and for inspiring them with patriotic
ideals. It can be very closely correlated with intro-
ductive science and civic biology, with which it is
scheduled to alternate.

"Problems of Democracy" is a title to cover a selec-
tion of the simplest elements of sociology, economics,
thories of representative government, and discussions
by modern leaders of the problems that
are now pressing democratic countries
for solution. Also it may include oc-
cupational information for vocational guidance. Stu-
dents in the higher grades in high schools are coming
to be interested intensely in these great problems; and
it is well that they should be. It is vital to the state
that they have opportunity to learn about the funda-
mentals of production, consumption, transportation,
money and exchange, conservation of health and natural
resources, education, charities, and correction. They
should learn the essentials about the governmental func-
tions of the executive, judiciary, and legislative officials
according to the best political theories. They should
know something of the problems of maintaining order and suppressing outlaws and bandits at home, the problems growing out of international relations, and how modern nations are dependent for their prosperity upon friendly and peaceful intercourse and trade with one another.

Such problems as these can be taught and discussed under the subject title "Problems of Democracy"; and the flexible character of the title leaves the school at liberty to make the wisest and most timely selection of principles and problems to be studied. The students should read up on these in textbooks and periodicals, and should discuss and debate on them both informally and formally in the classroom and auditorium. This course should be a special training ground for individual self-control and civic efficiency; and if given by a live, well-educated teacher, no course could be more valuable or inspiring to the individual or more vitally important to the state. It is given five days a week, and Modern Chinese History 5, in grade 12.

The reason for placing art as either an elective or a requirement in all courses is fully justified by the large place which art occupies in the domestic life and foreign trade of China. The native artistic interests and abilities, which are so widely disseminated among her people, must be fostered and cultivated; and the old artistic refinements and skills must be revived, redeveloped, and intensified. Appreciation of art products must become more intelligent and discriminating, more intense and enthusiastic, and more widely distributed. The way to bring this to pass is to teach drawing, color work, design, and applied art in every school. Thus can China develop one of her greatest native assets and make one of her greatest contributions to a new and more refined world civilization.

The art work now usually seen in the schools seems to lack motive, intelligent purpose, definiteness, and coherence of design. It seems to lack meaning. There
Present art instruction lacks definite purpose. is seldom found any relation between beauty of color, form, and substance on the one hand, and utility or purpose on the other hand. In school, after school, I have looked at the exhibits of art work produced by pupils and could find no evidence there of consistent and competent instruction in the fundamental principles of design: and in the fundamental principles of contrast and harmony of color. Here and there are beautiful productions, full of spirit and meaning; but these seem to be the result of the accidental presence of specially talented pupils or teachers rather than the result of consistent and purposeful systems of instruction.

In a country in which such excellent examples of the principles of design can be found everywhere, and in which the love for design shows itself though crudely even in the street vender’s arrangement of his wares for display, it is truly surprising that such lack of definite purposes and objectives in art instruction should exist in the schools.

The old processes and skills which produced the priceless art treasures of the old Chinese civilization must be preserved and handed down. The rising generation must be able to distinguish unerringly the beautiful from the merely grotesque or the purely ugly. It must also be able to discriminate between objects of real Western art and cheap imitations. All this can be done by correct and skillful teaching of art production and art appreciation in the schools and colleges.

Save the old art of historic China!

There should be more trained and broadly educated teachers of art in the Chinese schools, elementary as well as middle and higher.
### IV. The Household Arts Curriculum

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>GRADES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Art &amp; English</strong></td>
<td><strong>7</strong></td>
</tr>
<tr>
<td>Art</td>
<td>Drawing, Color and</td>
</tr>
<tr>
<td></td>
<td>Design 3 or English 3</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chinese</strong></td>
<td><strong>5</strong></td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td>Junior High School</td>
</tr>
<tr>
<td></td>
<td>Mathematics 5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural</strong></td>
<td>General Science 3</td>
</tr>
<tr>
<td><strong>Science</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>Community Civics 2</td>
</tr>
<tr>
<td><strong>Studies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Household</strong></td>
<td>Cooking 2</td>
</tr>
<tr>
<td><strong>Arts</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td><strong>5</strong></td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

Art or music may be elected up to a total of three additional hours a week in any year.
The Household Arts Curriculum is planned to provide a broad and thorough general training for the future home makers and women citizens of the new China who are not aiming towards a college education.

It differs from the General Curriculum by substituting courses in household arts, home management, home nursing, household budgets and accounts, and dietetics for the college preparatory mathematics. Also it makes English optional with a sequence of courses in drawing, color work, design, and applied art.

The need for such a curriculum for girls is becoming more and more apparent as the cost of living gradually rises, and as manufacturing steadily increases. The modern Chinese woman must know how to manage her home, and direct her servants in order to prevent the wastes and leaks that will be felt more and more severely by the family of moderate income, as the cost of living rises. If she wants the work done properly, she herself must know how it should be done, and be able to teach the servants. With the coming of industrial development, intelligent and skilled household servants will be increasingly hard to get and to keep. Then the housewife will either have to put up with unskilled servants whom she must train, or she must employ fewer servants and do more of the work herself.

When that time has arrived, training in scientific housekeeping with the aid of modern saving-of-labor devices will be very necessary. The schools must prepare for this time by beginning immediately to train the coming generation of women in household science and arts; for it is essential to the nation that its families be well housed, well clothed, and well fed. The safety of every nation lies in wholesome, happy, harmonious homes.
### V. The Industrial Curriculum

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>GRADES</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>Chinese Color and Design 5 or Chinese 5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>English 5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>Junior High School Mathematics 5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Science</td>
<td>General Science 3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Studies</td>
<td>Community Civics 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Practice</td>
<td>Manual Training 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Training and Athletic Games</td>
<td>Manual Training 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

Art or music may be elected up to a total of three additional hours a week during any of the six years.
The Industrial Curriculum is intended to give as broad and intensive training as possible to those boys who are mechanically inclined and who through preference or necessity will enter directly into industrial occupations, without college training, after graduating from a school of middle grade.

In this curriculum the college preparatory mathematics are replaced by mechanical drawing and shop work; English is made optional with Chinese in grade 10 and with art work or Chinese in grades 11 and 12. The sequence of prevocational or vocational industrial practice extends through six years and includes four and four fifths units.

For a mechanical training it may include courses in mechanical drawing, elementary woodwork, carpentry, cabinet making, wood turning and pattern making, forging, bench and sheet metal work, foundry practice, machine drawing and machine shop work, or automobile and other repair work, or plumbing and pipe fitting.

For training in the textile industries, the shop work may include ginning, weaving, spinning with domestic and power machines, dyeing, and machine maintenance and repairing. Many of the shop courses above mentioned excepting carpentry are represented now in the special technical schools.

A sequence of courses in millwrighting might well be added as a third line of work in Shanghai and some other cities. Expert millwrights are now much needed in China; and an increasing number will be in demand as the number and variety of factories continues to increase.

Other technical processes, such as leather tanning, soap making, and candle making, may be taught as vocational studies. Also there is much need for courses in electric wiring, electrical shop work and repairing, and power-station operation and maintenance, everywhere in China.
VI. The Commercial Curriculum

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>GRADES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Chinese</td>
<td>Literature and Composition 5</td>
</tr>
<tr>
<td>English, and Commercial Correspondence</td>
<td>Conversation, Reading, Writing 5</td>
</tr>
<tr>
<td>Mathematics and Commercial</td>
<td>Junior High School Mathematics 5</td>
</tr>
<tr>
<td>Natural Science</td>
<td>Introductory Science 3</td>
</tr>
<tr>
<td>Social</td>
<td>Community Civics 2</td>
</tr>
<tr>
<td>Physical Training and Athletic Games</td>
<td>3</td>
</tr>
<tr>
<td>Manual Training</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>25</td>
</tr>
</tbody>
</table>

Art may be elected in any year up to a total of three additional periods a week.

*May be made optional with shorthand 5 hours a week; or the school may offer a two years' evening course for graduates and employed youth (five hours a week) in shorthand.
The Commercial Curriculum provides a very strong course in preparation for business life or civil service. Parts of the time that, in the General Curriculum, are given to the literary studies of Chinese and English and to the formal study of algebra and geometry are, in the Commercial Curriculum, given over to special vocational and prevocational work in business practice. Thus we find business correspondence, advertising, and salesmanship in the Chinese language replacing formal literary study of Chinese in the eleventh grade, and parliamentary law, debating, and oral interpretation from Chinese to English or from English to Chinese replacing formal study of Chinese in the twelfth grade.

Typewriting practice is to be begun in the tenth grade and continued through the twelfth grade. It is to be carried on in connection with spelling, grammar, and rhetoric; and typewritten business English replaces formal literary study in that language.

Algebra and geometry, which are of little value in business education, are replaced by strictly vocational and prevocational instruction and drill in commercial arithmetic, bookkeeping and office practice, and by the study of costs, auditing, banking, insurance, investments, office and factory management, and the principles of personnel work (that is, methods of carrying on safety and welfare work, selection of employees, and promotion of harmonious business relations with them).

The introduction of these vocational and prevocational courses also necessitates the omission of physics and chemistry, which are desirable though not necessary; but time is still left for general science, civic biology, and general geography, which I regard as essential to intelligent citizenship. So also are the social studies; and therefore this curriculum includes all the social studies found in the General Curriculum excepting ancient and medieval history, which is intrinsically much less valuable than the other studies of the social science groups.
This curriculum is recommended either for the separate commercial schools which now exist or for the commercial department of a comprehensive high school such as would result from the union of several different schools of middle grade.

VII. THE AGRICULTURAL CURRICULUM

To make an excellent curriculum for students of agriculture, we have only to take the Industrial Curriculum and substitute for the four units of shop work in grades 9 to 12 a sequence of four units of agricultural studies. These should include soils, fertilizers and crops, animal and poultry husbandry, horticulture and bee keeping, drainage and irrigation methods, the mechanics of farm implements, and farm management.

In all these courses there should be an attempt to arouse interest in those improved Western methods that give promise of being so adaptable to Chinese conditions as to result in improving the quality and increasing the quantity of the farm products in China.

The "shop problems" unit of the Industrial Course should be replaced by farm accounting. A sequence of courses for specializing in sericulture may replace all or part of the sequence in general agriculture; and courses in various specialized phases of agriculture, forestry, etc., may replace English or Chinese as options in the last two years of the curriculum.

VIII. THE NORMAL SCHOOL CURRICULUM

Since prospective elementary teachers will have little or no use for the college preparatory algebra and geometry, it is recommended for the normal school students that the time which, in the General Curriculum, is allotted to these studies, be devoted to such subjects as school and class management, methods of teaching the elementary school subjects, and
elementary psychology. These, together with an hour a day for one semester in observation, practice teaching, and conferences (carried on in the last year, or twelfth grade), will make a very satisfactory sequence of pedagogical or professional courses.

Since drawing, color work, design, and handwork of various kinds are very important, and should be featured in the elementary grades, the prospective teachers should have good instruction in the fundamental principles of drawing, color work, and design, and in applied art, in order that they may master the principles of artistic appreciation and judgment. Also, they should learn how to select the kinds of art work that are adapted to children's abilities and interests, and should understand how to teach art and handwork to children. Hence it is recommended that a sequence of courses in drawing, color work, and design be substitutes for the sequence of courses in English which appear in the General Curriculum.

With these substitutions of professional and art courses for the English and college preparatory mathematics sequences, the General Curriculum is converted into a fairly satisfactory "Normal School Curriculum." However, I urgently recommend that as soon as it may become feasible, the normal course for elementary teachers shall be made a two years' course based on graduation from the senior middle school, and that the entire two years be given to professional studies in preparation for teaching; including elementary and educational psychology with laboratory work, school and class management (including school records, promotion standards, etc.), and methods of teaching the elementary school subjects, especially oral and silent reading, writings arithmetic, geography, Chinese history, and nature study.

History of education, principles of education, school administration, and general methods of teaching are all valuable subjects for the training of teachers; but these should not be allowed to crowd out such essential
and practically useful subjects as those previously mentioned. The former advanced subjects may well await the opportunity to pursue them in advanced college or graduate classes.

Ideally, the elementary teachers should have a full four years’ normal course based on graduation from the middle school; and this would give time for thorough study of these more comprehensive subjects, as well as for some general college work in such allied subjects as sociology, history, economics, natural science, philosophy, and literature. However, it is probable that considerable time will elapse before it becomes practicable in China to require elementary teachers to have such advanced training, or even to provide such training for those who desire to take it.

In the meantime, the two steps that are feasible are, first, the improvement of the present normal curriculum, and later on, the establishment of two-year junior normal colleges based on graduation from the middle school.

The economic status of rural teachers is so low that not many graduates of a four-year primary normal curriculum will go into the country to teach. Graduates of a junior normal college would be still less likely to do so. Probably for a long time to come, most of the rural teachers will have to be recruited from graduates of the junior middle schools who must teach for a while to get funds to go on with their education. This problem ought to be looked into seriously.

In the meantime, however, the normal course of middle school grades and the two-year junior normal colleges are needed for the training of city elementary teachers and rural and city supervisors; so the former ought to continue and the latter ought to be established as fast as circumstances will permit.
CHAPTER 18

SCIENCE ROOMS AND BUILDINGS

I. OBSERVED CONDITIONS

The Chinese educational buildings fall readily into four classes:

1. Old Chinese one-story residences, temples, and yamens.

2. Narrow, oblong two-story buildings with single line of schoolrooms approached from open corridors, with end stairways, facing a rectangular courtyard or garden plot.

3. Wider rectangular two-story buildings with med- dial interior corridor and a central entry hall at right angles to it, the rooms being arranged in rows on the two sides of the main corridor.

4. Modern or semi-modern brick or concrete build- ings on the E or H plan, of two or three stories, sometimes with basement or attic or both. These latter are mostly confined to colleges and technical schools.

In many schools, combinations of buildings of two or more of these four types exist. Most of the buildings are of brick or wood or are combination structures of brick, wood, and stucco. These are non-fireproof, and have no fire escapes.

In about thirty per cent of the buildings of the first- named class the lighting is very poor; but in those of the other classes it is usually passable; and in about ten per cent of them it ranges from good to excellent. The cases where the lighting is excellent are almost all in missionary colleges in buildings recently erected. In nearly all the Chinese buildings the rooms

Many of the buildings are faulty; a few are good.
are lighted from both sides, giving rise to cross shadows; but in a few of the buildings of the third and fourth classes there is adequate light from the left side only, as should be the case. In a few of the schools there are electric lights for use on dark days; but the cases where such lights are sufficiently numerous and well distributed are very rare. This is not so serious in the north where clear skies prevail; but in the south, where the sky is dull so much of the time, the inadequacy in both natural and artificial lighting is very serious. Cross shadows, and lighting from the right or rear exclusively are of course always bad for the student's eyes.

In about seventy-five per cent of the cases observed, the windows are too short; and in many of the rooms where the windows are long enough, their length is unavailing because the most effective skylight (that which otherwise would come through the upper portions of the windows) is cut off by the floors or roofs of the upper corridors, or by the overhanging eaves of the main roof.

Many of the schools have electric lights, but few have a sufficient number of these. Special rooms for science work are very rare in the middle schools and normal schools, where the layout for science usually consists only of an ordinary classroom and one stock room, the latter frequently in another building, and not, as it should be, adjoining the classroom. Sometimes there are two stock rooms, one for physics and chemistry and one for biological apparatus; but even this is rare.

The Practice Middle School of the National South-eastern University at Nanking has separate laboratories of ample size and well furnished, for physics, for chemistry, and for biology and general science. Each has its own adjoining stock room, and the school is quite well supplied with apparatus. This is one of the few schools of middle grade that are at all adequately equipped with laboratories and classrooms properly arranged and furnished; and it may serve to present a
fairly good model of an economical science equipment. The Wayland Academy at Hangchow, and the Union Christian Normal School at Wuchang are among the very few mission middle schools that are well equipped for science. Most of the mission middle schools, and most of the middle schools attached to Chinese private collegiate institutions use the science rooms belonging to the collegiate departments. This is the case, for example, with Chung Hua University at Wuchang. Nankai College at Tientsin has a middle school that is well provided with science rooms and equipment, and like that of National Southeastern University, does a really high grade of science work. The middle technical and agricultural schools usually have chemical laboratories, and carry on a good grade of laboratory work in that subject; but one scarcely ever finds a laboratory for physics or biology. Sometimes there is a room with students' tables for physics, but no laboratory apparatus for that subject. In such cases a small amount of laboratory work is done with the demonstration apparatus.

II. A UNIT SYSTEM OF STANDARD SCIENCE ROOMS

The task of planning a building or rooms for science instruction or of adapting or remodeling existing rooms for this purpose can be much simplified by devising a unit system in which a room of specified dimensions is adopted as a standard unit, and all other rooms are simple fractions or multiples of this unit. I recommend as a science room unit, a room 24 feet wide, 32 feet long, and 12.5 or 13 feet high, having a consequent floor area of 768 square feet and a cubage of 9,600 cubic feet. With these dimensions as a basis I have worked out the following series of dimensions for science rooms of all sorts. All these rooms have a uniform height and width; and rooms of different sizes are made by varying the length, which in general is simply related to the standard length of 32 feet.
a. The unit room, $24 \times 32$ feet, makes a large classroom accommodating thirty-six to forty students, and a standard laboratory for chemistry accommodating at one time twenty-four or thirty students, according to the type of laboratory table that is used. It also makes a standard laboratory for physics, biology, agriculture, or "general science," in each case accommodating at one time twenty-four or thirty-two students, according to the method of furnishing.

b. The one-and-a-half unit room makes a large laboratory, $24 \times 48$ feet, suitable for college sections, enrolling from thirty-two to forty, where the professor has an assistant to help in directing the students. It is necessary for large sections in chemistry, but may be used as a large laboratory, or as a combined laboratory and classroom useful in a small school for any of the other sciences. This room is suitable also for library, museum, or study hall, or for a small lecture hall accommodating sixty students.

c. A unit can be divided so as to make a large stock room or a small classroom $24 \times 21.5$ feet ($\frac{3}{4}$ of a unit) accommodating twenty-four students, and a small special room.

d. The small special room $24 \times 10$ ($\frac{1}{3}$ of a unit) is suitable for a small stock room, a balance room, a small office or research room, a dark room for photography, photometry, spectrosopy, etc., or a foul gas room adjoining a qualitative chemistry laboratory.

e. Two units can be divided into a one-and-a-half unit section as described in b above, and a one-half unit section. The half-unit section $24 \times 16$ can be used as a medium-sized stock room or a stock and preparation room, as a large office, a departmental library, or as a teacher's combined office and private laboratory. Two rooms approximately this size can also be obtained by dividing one unit by a partition into halves (six inches being required for the partition).
III. Standards for Lighting of Rooms

For the proper lighting of educational rooms the following standards are recognized:

1. For average conditions as to daylight, the clear glass window area should be equal approximately to one fifth of the floor area. It should never be less than the minimum of one sixth of the floor area.

2. The forward window in a large classroom should be about eight feet from the front wall of the room. In small rooms this distance may be reduced proportionally.

3. Window sills should be from three and a half to four feet from the floor.

4. The height of the tops of the upper window sashes above the floor should not be less than one half the width of the room.

5. For all rooms where much writing or drawing work is to be done, all the light should come from the left side.

For the unit size room, $24 \times 32 \times 12\frac{1}{2}$ feet or 13 feet, standards 3 and 4 require that the window glass shall reach to 12 feet from the floor and that the windows shall be 8 feet long.

For every foot of its length, any of these rooms has an area of 24 square feet. One fifth of 24 is 4.8, the number of square feet of window glass for each foot of room length. 4.8 square feet (the area) divided by 8, the length of the windows, gives 0.6 foot, the width of window glass per foot of room length, for any of these rooms.

For a unit-size room, therefore, the total width of window glass, 8 feet high, must be $0.6 \times 32$, or 19.2 feet. This would require 6 windows, each $3\frac{1}{4}$ feet wide. Similarly a unit-and-a-half room requires 9 such windows, a half-unit room 3, a standard classroom 4, and a small office or special room, $24 \times 10$ feet, requires 2.

These windows are most effective for good lighting as well as for external appearance if massed in pairs, or in
groups of three, four, or five, each group in one frame with narrow mullions of wood or iron between the sashes. Massing the windows in this manner is feasible from an engineering standpoint in buildings of modern construction with steel or concrete frames. It is also feasible in the Chinese wood-framed building of the fine old type used for temples and yamens, many of which have been remodeled for schools.

The advantage of the mullioned windows is that they eliminate the sharp shadows such as are made by the piers which must be left between windows in the old type of brick building. The inside and outside corners of the mullions, sash divisions, and window frames should be beveled off, so that their cross-sections shall be double wedge-shaped (thus \( \diamond \) or thus \( \downarrow \)) instead of rectangular. This enables them to admit more of the light that comes diagonally to the window and that would therefore be cut off by the corners, if the corners were not beveled off. This device increases the available light; and it also helps in the further elimination of sharp shadows.

The manner of hanging the sashes on side hinges like doors, which prevails in the Chinese schools, is not by any means the best. The best arrangement is to mount the sashes on swivels, so that each sash can turn about a horizontal axis at its middle line. This makes the windows easier to handle, both for ventilation and for washing. All windows excepting those facing the north should be fitted with semi-transparent spring-roller shades of strong cloth. The best color is a light buff or yellow. For the swiveled windows above described there must be a shade for each sash (the upper and the lower). It is best to mount the shade on the lower rail of the sash and have it arranged so as to be drawn up by a pulley attached to the upper rail of the same sash.

For windows that slide up and down in their frames, an adjustable shade of the Draper type is best. This is suspended from a pulley at the top of the window frame, and rolls up automatically when a handle at the bottom is pressed. By means of the cord and the pulley
the whole shade can be raised or lowered. Thus the shade can be adjusted to any length or at any height. It is sold by the Draper Sales Company, Spiceland, Indiana, U. S. A., and advertised in the most prominent American educational journals. The purpose of a shade is to diffuse the direct rays of the sun without excluding the diffused light from the room.

Buildings should be so placed that as many as possible of the classrooms may get the light from the east or west and so that the distance from the schoolrooms to any building, hill, or other obstruction shall be not less than twice the height of the obstruction. This latter rule is often violated, with the result that an obstruction of some sort cuts off a large part of the sky area from which the light that is to illuminate the room must come. For this reason and for the sake of good drainage, good air, and a pleasant outlook, it is advisable, if possible, always to place school buildings on high ground rather than on low ground.

The prevailing type of Chinese school building is faulty as to lighting from causes other than those already mentioned:

a. Most of them have windows at the right or at the rear as well as at the left, and some even in front. Windows from two sides cause cross shadows which are ruinous to students' eyes. Windows in front are bad, since the students get the light directly in their eyes instead of on their books or papers. Windows at the rear are useless if there is adequate light from the left; and if there is not, the rear windows help very little, since the heads and backs of the students cut off the rear light from their books and papers.

b. In a great many of the buildings in China, even when the rooms are supplied with adequate windows on the left, these windows are rendered ineffective by the overhanging eaves or open corridors on that side of the building. The open corridor type of building is less costly than other types, and is well
adapted to customs and conditions in Central and South China, provided it is correctly designed. However, when this type of building is used, it should have the windows for lighting on the left-hand side and the open corridors on the opposite or right-hand side. Since natural cross ventilation is necessary in these buildings, there should be transoms over the doors, and also, in the right-hand wall, short windows (for ventilation) at least seven feet above the floor. These openings will not produce cross-lights because the corridors or eaves on that side will shade them.

Two such buildings can be placed close together if the corridors are placed on the sides of the two buildings that face each other. If, however, the sides that face each other are also the sides from which the interiors of the rooms are lighted, the court between the two buildings must have a width equal to twice the height of the highest part of the roof of the higher building—otherwise each building will cut off the skylight from the other.

IV. HOW TO PLAN A BUILDING OR ROOMS FOR SCIENCE WORK

With the foregoing principles in mind, if one has to plan a school building, he should make a tabulation of the present or proposed curriculums and organization of classes and sections, with due attention to the probable future growth of the school and development of the curriculums. From this tabulation the number and sizes of the rooms that will be needed should be determined. These rooms may then be drawn to a uniform scale, preferably on stiff cardboard, and cut out.

The cut-out plans of the rooms may then be laid out on a flat table, and assembled by trial in different ways until the best grouping of them in the general floor plans of the building has been determined on. When this has been decided, the cut-out units can be pasted down on
a large sheet of cardboard, making a rough preliminary plan of each floor of the building.

The final step can then be taken with the architect, who can draw his plans from the cardboard. He should confer with the principal and teachers before making such modifications as may be necessary. The architect may have to make some changes in order properly to work out the engineering features of the building and perfect its general exterior and interior features, such as the shape of the ground plan, the various exterior elevations or façades, the corridors and stairways, and the flues and shafts for heating, plumbing, wiring, etc. The best ground plans are those in which the unit rooms are arranged in the form of a hollow rectangle, or three sides of a rectangle, or a letter E or a letter H.

In planning the location of the rooms for science the following principles should be borne in mind:

1. The rooms to be used for a given science should be grouped together. If possible the stock and preparation room should be between the classroom and the laboratory, so as to be conveniently near to each.

2. In general it is better to have all the rooms for any given science on the same floor.

3. Departments which can make use of the same classroom, and to some extent of the same apparatus, should be placed near each other.

4. Whenever a new building is planned, especially for science, shafts and conduit tubes should be provided for the distribution of plumbing and heating pipes and electric wires to the different rooms where they are needed. With such vertical shafts and horizontal conduits, made so as to be easily accessible, plumbing or wiring may be added, repaired, or changed without tearing out floors or walls.

5. The classrooms for physics and general science should, if possible, have a southern outer wall, and a window or round opening in it, through which direct
sunlight may be admitted by means of a *porte-lamier* or *helioslat*, for experiments in optics. Once in the room, the beam of light may be directed, as desired, by mirrors.

6. The biology laboratories are best lighted from the north, as the north light is best for work with microscopes. On the other hand, for the sake of growing plants used in botanical studies, the classroom for this department should have an east or west exposure. A south exposure would be better for plants; but to get it, the laboratory and classroom would have to be at opposite ends of the building. If, however, the biology rooms are in a wing with an east-west axis, and with the rooms facing north and south on opposite sides of a central corridor, this difficulty need not arise.

7. The architect must have a certain amount of liberty in making changes from the arrangement favored by the principal and teachers; but they should insist that he adhere to the most important standards and principles that have been set forth above.
CHAPTER 19

CLASSROOM AND LABORATORY FURNISHINGS

I. CONDITIONS OBSERVED IN THE SCHOOLS

The thing that first attracts the observer’s attention in the science department of nearly every middle school is that the science classroom differs not at all from any of the other classrooms. Seldom does one see a convenience of any kind such as a Western science teacher would consider almost indispensable. There is usually, at the front, a small pulpitlike reading desk, with a top area about 2 by 3 feet. It is placed on a raised platform. On this the teacher usually stands continuously behind the desk and lectures, occasionally turning to write or draw on the blackboard just behind him. This blackboard will usually be about 6 feet long and 4 feet wide; but it may sometimes be 8 or 9 feet long, or it may be a double sliding board. Sometimes, but not often, it will be flanked by two stationary boards about the same size. Rarely indeed does one find any other blackboard space in the room.

Most of the equipments are inadequate.

The students’ desks are usually double; but sometimes are built for three or even four students. Single desks are sometimes found; but they are not very common.

The seats are usually rather crude chairs, not anatomically constructed, and not adjusted to the desks for correct posture in writing. Sometimes benches are used instead of chairs; and these are better, as they permit the students more easily to assume a correct posture, and they are even less expensive than the chairs.

Often the benches and chairs are placed on rising platforms. The greatest and most common fault of the
furniture is that it is weak and shaky; but the students pay no attention to discomforts. They seem able to disregard them totally, which is indeed a very useful ability. More often than not one finds a picture or two or a few science charts on the walls; but the good Chinese pictures, if there are any, are reserved to the reception room.

With this description it becomes clear that the important and almost universal lack in the classrooms is of blackboard space and table space on which to set out apparatus for experiments and demonstrations.

When one steps into the stock rooms, he finds that most of them are inadequate in many ways. These are some of the faults:

1. Room too small. Cases too closely crowded or not enough cases.
2. As a result, apparatus piled in corners on the floor, or on top of cases, in a disorderly condition, and covered with dust.
3. Because the shelf space is inadequate, the apparatus will be crowded into the cases without any systematic order; so it is hard to find when wanted. Also there is great difficulty in removing a needed piece when found, without disturbing other pieces and subjecting them to great danger of breakage.
4. Usually the cases are poorly made; and as a result they cannot be properly closed so as to protect the apparatus from dust or to keep it from being removed by irresponsible persons.

The result of these conditions usually is that the apparatus has deteriorated; and much of it has disappeared; while the remainder, being more or less inaccessible, and in a dusty, disagreeable condition, is little used.

There are exceptions of course. In some cases the apparatus is fully used, and is kept systematically and in good condition. In most of such cases it was found that the stock room was of ample size, that the cases were well built, provided plenty of shelf room, and could be kept tightly closed and locked.
There were other exceptions, when the apparatus was so bright and shining as to make one doubt if it were ever used to experiment with.

The few chemical laboratories found in schools of middle grade were equipped with tables of the usual sort, mostly made by local carpenters, and answering their purpose very well. These all have lockers; but the lockers are seldom used. On account of the limited funds available to the schools, it is customary to issue the supplies to the students each day from the stock room, and to have them returned to the stock room at the end of the period. In this way the school does not have to keep so large a stock on hand.

The chemical laboratories when they exist usually have one or more fume hoods, but few of these work; because no means is provided for creating an effective draft.

Nearly all the schools having chemical laboratories are embarrassed by the lack of a supply of gas and running water. These handicaps are not encountered by schools in the foreign sections of Tientsin and Shanghai; but excepting in such cities where large sections are controlled by foreigners the lack of central gas and water supply must be overcome by such expedients as the teachers can devise. In some cases water is drawn from iron tanks or wooden tubs, placed in the room and filled by coolies. In some localities rain water is collected from the roof in an elevated tank and is piped into the room. A few of the best higher institutions, including many of the missionary colleges, have installed water systems of their own.

In a great majority of the laboratories simple alcohol burners and alcohol blast lamps are used for laboratory heat. Several government institutions have gasoline gas plants; but most of these are out of commission because of the want of skilled supervision and care. Shanghai Baptist College has installed a Mansfield oil gas generator, which is expected to be most satisfactory; but there was much delay in getting it started; and I am not informed as to whether it is now being used.
Laboratory facilities for biology and physics are very seldom provided. Occasionally a school was found where some laboratory work was done on ordinary school desks, or on the desks provided for chemistry. Such cases are rare, and the number of experiments very small.

Such being the usual conditions, the few teachers who have been able to surmount them and do some good demonstration or laboratory teaching, naturally came in for a large share of interest and admiration. Occasion was taken in such cases to give the teachers all possible encouragement to develop their strong points and successes to new levels.

The remainder of this chapter is devoted to description of classroom and laboratory fittings and furnishings, with the hope that an organized movement will soon come for better teaching methods in science, and that some standards in printed form may be very helpful to those who have to solve the problem of getting their schools equipped for more modern types of work.

II. Demonstration Tables

Attention has already been called to the fact that in most of the schools the demonstration tables are too small. I recommend for standard dimensions: length, 12 feet; width, 2 feet; height, 3 feet 1 inch.

The table top should be made of seasoned lumber, at least 1½ inches thick, matched and glued together and reënforced underneath by transverse cleats to prevent warping. The tops of demonstration and laboratory tables should be finished with a dressing of paraffin ironed into it. This makes it waterproof and also to a considerable extent acid-proof. Concrete tops are used in some laboratories in China; but they are liable to become cracked. Also they are somewhat dangerous to glassware and they soon become rough and badly discolored.

Several floor plates should be countersunk into the table top and secured by wood screws. These should
be of such size that stout steel rods can be screwed into them for supporting apparatus. These rods and plates, plated with nickel, are supplied by apparatus dealers or can be made to order by local manufacturers. The best size of rod for this purpose is one approximately \( \frac{3}{4} \) inch (19 millimeters) in diameter and 4 feet long (120 centimeters). A steel or wooden crossbar can be clamped to two of these rods at any height by means of right-angle clamps.

The space underneath the table should be divided and furnished with closets and drawers of different sizes to serve as receptacles for such apparatus, tools, and supplies as are likely to be frequently needed. Where gas, electricity, and hot and cold running water are available, the lecture table should be equipped with a sink, water and gas taps, and with plugs and receptacles for the electric current.

III. Laboratory Tables for Chemistry

The students’ table for chemistry should be 4 feet wide and 3 feet 1 inch high. The length of the table may vary according to preference and according to the conditions to be met. A table 6 feet long accommodates 4 pupils, 2 on each side. In a small chemical laboratory (1 unit, or \( 24 \times 32 \) feet) six 6-foot tables may be placed in two rows of three with their long axes parallel to the front and rear walls. These will provide for 24 students working at one time. An aisle 3 feet wide may be left between the two rows of tables, and leave aisles also between their outer edges and the side walls. These aisles each can be 4 \( \frac{1}{2} \) feet wide, which will leave room for shelves and cabinets next to the wall. Allowing 4 \( \frac{1}{2} \) feet working space between the tables, there will remain 11 feet of space to be used at the front and rear for working space at the tables and for access to the shelves and fume hoods, which may be placed against the front and rear walls. If the tables are made
12 feet long, they may be placed in a single row of 3 down the middle of the room. This will eliminate the middle aisle, but will give 1½ feet more of aisle space on each side. This arrangement provides for twenty-four students at one time as before. Finally, if the tables are made 15 feet long and placed in a single row of 3, the space next the outside walls will be the same as in the first arrangement, excepting that the middle aisle is sacrificed in order to get working space for six more students, or thirty in all, working at one time.

The working space for each student is $3 \times 2$ feet. Under this working space can be built lockers and drawers in which the students’ apparatus and supplies may be locked up.

**Lockers.**

1. The common method of division is to make two lockers and four drawers in each 3-foot space, and assign one locker and two drawers to each of two students, who will belong to two different sections and will work at the same table space at different times. Thus a laboratory that will accommodate twenty-four or thirty students working at one time can be used during one semester by forty-eight or sixty students. There are other possible arrangements that are more economical in the use of storage space as follows:

2. According to the “Fales unit system” the 3-foot linear space is divided vertically into three locker sections or units. Each of these sections pulls out on rollers independent of the others, and consists of a rack very ingeniously arranged with pegs, slots, and trays for storing an entire students’ outfit for a semester’s work. This is a very convenient system, but the first cost of installing it is relatively high. With this arrangement one table will accommodate three sections of students, or for the standard size laboratory seventy-two or ninety students in all. The Shanghai Baptist College laboratory has this system.

3. The space may be divided vertically into three sections. The middle section may be furnished as a
cupboard containing one drawer, for apparatus that will be used in common by all the students using the 3-foot space. The other two sections are divided horizontally, each being fitted with a vertical row of three drawers. With this arrangement, each table will accommodate six different sections during one semester, or a maximum of one hundred forty-four or one hundred eighty students. If there are only three sections, each student may be assigned two drawers instead of one. This arrangement is the most economical for a large and growing middle school, since one standard laboratory will suffice for six sections.

4. If economy of construction combined with student capacity is the condition most necessary, the space may be divided into four equal sections, two upper and two lower; and these sections may be furnished as simple lockers. Inside, the lockers may be equipped simply and cheaply with such pegs, shelves, or racks as are desired. One of the lower lockers if not needed for a fourth student may be left open for a waste jar for acids and refuse that may not be thrown into the sinks. The writer once equipped a laboratory of this kind; and it proved to be very satisfactory.

Where running water, gas, and direct electric current are available for distribution, each student table should be equipped with water and gas pipes; and an electric receptacle and plug should be provided for each student's working space. In order that these openings may be convenient and yet out of the way of the students, and also in order that the pipes and wires may be open and easy to get at for repairing, the pipes and wires are best placed lengthwise and above the tables. The best place for them is just underneath the reagent rack.

In many laboratories sinks are placed in the table tops, at the center of the working space for four students. Since these may be provided with shelves and standing waste pipes, they have the advantage that they can be used as pneumatic troughs for collecting gases. On
the other hand, the first cost and also the cost of repairs is greatly increased by having so many sinks and waste pipes.

A better arrangement, especially for Chinese schools, is to fit each table with a lead-lined gutter, 5 1/2 inches wide and 2 inches deep at one end, and slanting down to 5 inches deep at the other end, where it drains into a single large sink made of soapstone or acid-proof earthenware. This sink is about 14 x 18 inches in area and 10 to 12 inches deep and is supported on a wooden rack or iron brackets attached to the end of the table. This arrangement reduces the plumbing to a minimum, and leaves all piping exposed to view and easy of access. When gases are to be collected, portable pneumatic troughs can be conveniently used. In China, these can be made by a local sheet-metal worker from galvanized sheet iron; and they are very cheap.

The reagent rack may consist of one or two shelves extending along the full length of the table at its middle line. The lower shelf may be about 6 inches wide and the upper 5 inches. The shelves should have retaining rims to keep the bottles from falling over their edges. The lower shelf should be at least 11 inches above the table top, in order to give adequate clearance for the water taps which lead from the pipes placed just beneath the shelf.

Each drawer or locker for students’ apparatus must have a lock which cannot be opened by any key excepting that belonging exclusively to it. Such locks are manufactured in America, each with two keys, and with a master key for the whole set, to be held by the instructor in charge. These locks, however, are expensive; and it is always bothersome to maintain an efficient system of caring for the keys. For Chinese schools it seems advisable to recommend that the lockers be provided with eyelets for locking them with a padlock, and that each student be required to supply his own padlock which he may retain or sell to another student when he leaves the course. Chinese
padlocks are cheap, and will answer the purpose very well.

Chemical tables and demonstration tables should be so constructed as to have ample toe space adjoining the floor, so that the workers' toes may extend under the table when they are standing close to it; otherwise the students will be subjected to great discomfort.

IV. Laboratory Tables for Physics

For a middle school laboratory, the best dimensions for tables are, length 6 feet, width 3 feet, and height 3 feet 1 inch. For college physics a width of 4 feet and a height of 2 feet 6 inches is often desirable. The tables should be of very solid and substantial construction, strongly framed so as to be free from vibration. The tops should be at least 1\(\frac{3}{4}\) inches thick, of seasoned lumber, matched, glued, and braced with cleats. They may be finished with an oil dressing or with a paraffin dressing such as is used for chemical tables. The edges of the tops should overhang the frames at least 2\(\frac{1}{2}\) inches all around, in order to give space for attaching clamps for apparatus. It is of great advantage to have a shelf at least 18 inches wide underneath the table, secured to cross braces at the ends of the table between the two pairs of legs. Drawers and lockers are not needed for individual use of students in physics; but they may, if desired, be placed underneath and used for storage of laboratory apparatus. Three drawers may be placed in the rail on each side of the table. Also an extra drawer and a locker may be placed underneath the middle drawer on each side. If, as is often the case in small schools, the laboratory is to be used for both chemistry and physics, and perhaps also for agriculture, biology, or general science, the drawers and lockers will be wanted for individual student's use.

For many experiments, two upright rods and a movable crossbar are needed. The uprights may be of wood and bolted to the ends of the table at the medial line, or they
may be steel rods similar to those recommended for use on the lecture table. Floor plates into which these rods can be screwed may be countersunk into the table top on the middle line near each end; or, better, four of these plates may be used, and so placed as to form the four corners of a rectangle about 3½ feet long and 2 feet wide. With these, two pairs of rods and two crossbars can be used; and the crossbars can be supported either lengthwise or crosswise of the table. This makes it possible to use rods and supports combined with right-angle clamps for supporting various kinds of apparatus in many different positions.

Where fuel gas and electric current are available for distribution, each table should be provided with four gas cocks and four plugs and receptacles for electricity. For gas, two two-way distributors may be placed at each end; or if the gas is distributed from the ceiling instead of the floor, a five-way distributor may be connected by means of a rubber tube with the fixture above the table. This arrangement has the advantage that the distributor may be removed when not wanted, leaving the center of the table clear of obstructions.

In a standard size laboratory these tables may be placed in two rows of three tables each, leaving a 2- or a 3-foot aisle down the length of the room, and ample space between tables and also between walls and tables, all around the room. A shelf 18 inches wide may extend along the rear wall of the room and along the outside wall next the windows. This shelf should be bracketed to the wall, and may be used as extra working space for students and for many other purposes. The space under it may be filled with drawers and lockers for the storage of laboratory apparatus, where it will be as near as possible to the tables on which it is to be used. This is an advantage in economy of space, time, and labor which can scarcely be overestimated.
V. Tables for Biology

For laboratory work in biology it is desirable for the students to be seated during most of the time, so tables for this purpose should be only 2 feet 6 inches high. Otherwise the tops and frames of the tables should have the same dimensions, construction, and finish as those recommended for physics.\(^1\) It is a convenience to have sink, running water, and gas connections at each table; but these are not necessary.

Since drawers and lockers are needed for the use of individual students, these should be built into the space underneath the tables. Three drawers may be placed in the rails on the long sides, and a fourth drawer and a locker may be built under the middle drawer on each side. This will provide drawer space for eight students working in two different sections. If there are more sections to be provided for, the spaces occupied by the lockers may be filled instead with three additional drawers on each side. This makes fourteen drawers, which provides individual drawer space for fourteen students, working in four sections.

These tables may be placed in two rows of three, exactly as described for the physics laboratory, or if desired the two rows may be placed closer together, sacrificing the center aisle space in order to gain more space between the tables and side walls. A laboratory so furnished will accommodate twenty-four students working at one time; and the capacity may, in emergencies, be increased to thirty-two by letting eight students work at the wall shelves at the side, front, or rear of the room.

Stools should be provided for the students to sit on.

---

\(^1\) Some biologists prefer tables shaped like an isosceles trapezoid with its wider base placed next to the window. This form has both advantages and disadvantages compared with the other.
VI. TABLES FOR OTHER SCIENCE WORK

For "general science" or agriculture, the laboratory may be furnished with tables and wall shelves entirely similar in construction and arrangement to those recommended for biology.

For a geography laboratory the tables should be four feet wide in order to provide more space for working with maps, charts, models, etc. In small schools, where there are only one or two sections in each class, or where some of the science subjects are given only in alternate years, the same laboratory may be used for two or three different sciences. For example, the chemistry laboratory may be used for agriculture or general science, and the biology laboratory may be used for physics, agriculture, or general science.

Sometimes the same laboratory is used for both physics and chemistry; but this is not advisable, because most physical apparatus rapidly becomes injured if exposed to the fumes generated in chemical experiments.

VII. FUME HOODS FOR CHEMISTRY

Fume hoods may be constructed in single units, or in combinations of two or more units. A unit should provide a working space of $2 \times 3$ feet, the working top being 3 feet from the floor. The space under this working top may be filled with cupboards provided with shelves for stock reagents and solutions, and other materials that must be ready at hand. The hood proper is a rectangular glass case with wood frame covering the working top, and is from 4 feet 6 inches to 9 feet high.

The front should be a window, the lower sash of which slides up and down in its frame and is counterbalanced by weights. If the top of the hood is less than 6 feet above the working shelf, it also should be of glass. It should slope upward toward the vent pipe, which should be placed near the wall and...
on the side nearest the flue. It the laboratory has a gas supply, two gas cocks should be placed on the front rail under the two ends of the working shelf, which should be perforated with holes just above the gas cocks to admit rubber tubes for connecting them with Bunsen burners inside the hood.

It should be borne in mind that fume hoods are of no use unless the flue with which they are connected has a draft that is strong enough to carry off the foul gases from all the hoods as fast as they are generated. Accordingly, a flue for this purpose must be provided with a heater or with an exhausting fan that is sufficiently powerful to keep the gases moving through it at the desired maximum speed.

A draft flue is necessary.

The hood units may be grouped in combinations of two up to eight, as desired. For the standard-sized laboratory, 24 × 32 feet, for general chemistry, accommodating twenty-four or thirty students, there should be six or eight hood units. These may be located all at one end of the room, or along the inner side, as desired, or according to location of the flues, which should be provided in the walls for the purpose. In case of old Chinese buildings, where there are no flues, the difficulty has been overcome by making hoods of some of the windows, and carrying the vent pipes directly to the outside. This scheme will work if the vent pipe is made long enough, and if a lamp is kept burning at its entrance to create a draft. It has the serious disadvantage of cutting off much of the needed light that should come through the windows.

In college laboratories for qualitative and quantitative analysis and organic chemistry one of the hoods should contain a steam evaporating bath if the building is heated by steam. In the absence of steam the bath may be heated by a small stove. It is also desirable for some purposes to have one of the hoods equipped with a sink and water tap.

The front wall of the room may be reserved for blackboards and open shelves for side shelf reagents
or for cabinets for specimens, etc. The side wall space
not taken up by doors and hoods may
be filled by specimen or reagent cabi-
nets, a bulletin board, and a table for
glass working.

VIII. OTHER FURNITURE

Stools should be provided for all laboratories; for even
in chemistry and physics, although most of the work is
usually done standing, the students may be seated during
part of the time. Stools to accompany
Stools.
tables 3 feet 1 inch high should have a
height of 2 feet. Those to be used with tables 2 feet 6
inches high should have a height of 1 feet 6 inches.

Apparatus cases can best be made in units 8 feet long
Apparatus and
and 6 feet 6 inches high. For physics apparatus and for
supply cases.
natural history specimens they should be 1 ½ feet deep;
but for chemical and biological apparatus,
and supplies of chemicals and reagents,
and for bookcases, a depth of 10 inches
is ample. They may be made with either hinged or
sliding doors. The sliding doors are better if space is
scanty, but they must be very well made, and of seasoned
lumber, else they will warp and stick.

All cases and drawers should be made dust-tight. This
is especially important in the northern provinces where
in many cities the dust is very bad. In the chemical
laboratory, the side shelves on which reagents for common
use are kept should be without doors.

Apparatus cabinets may be made without wooden
backs, provided they are fitted and joined to the wall so
as to be dust-proof. In the physics laboratory, cup-
boards and drawers may be built in under the wall shelf
along the side and rear end of the room in sufficient
numbers and of suitable sizes to contain most of the
smaller pieces of apparatus used for the various labo-
atory experiments; and so tall apparatus cabinets will
not be needed. Large or tall pieces must be kept in the
stock room. There should be in the laboratory a good-sized sink with three or four water taps.

In the biological laboratory, wall space may be used for working shelves with cupboards and drawers underneath as described for the physics laboratory, but some space should be reserved for specimen cabinets. The aim should be to provide cabinets and drawers in sufficient number and sizes so that as much as possible of the laboratory apparatus for the use of individual students may be stored near where it is to be used. Thus it can be easily and quickly obtained when wanted, and stored away just as quickly after the students have finished using it. Among the additional essentials in the furnishing of a biological laboratory are a sink with two or more water taps, an aquarium, a glass front microscope cabinet (if the laboratory is equipped with microscopes as it should be, if possible), a herbarium cabinet, window boxes for plants, and live-cages for insects and small animals.

All apparatus cabinets should be made with adjustable shelf supports. Cabinets for storage of herbarium specimens, small maps, drawings, etc., should have shelves 2 to 2½ inches apart, so supported that each shelf can be pulled out like a drawer.

All cabinets that stand on the floor without legs should have toe space, as described in connection with demonstration tables for chemistry. In addition to the fixtures already described each laboratory should have a bulletin board, and at least eight feet of blackboard. A special cabinet for students' notebooks is also desirable.

IX. Science Classrooms

The classroom for each science should be near the laboratory, and both should be near the stock and preparation room where the apparatus and supplies are kept. Hence the best arrangement is to place the stock room between
the classroom and laboratory and to provide it with doors opening into both rooms.

It is convenient to have a shelf and window behind the demonstration table, through which apparatus may be passed from the preparation or stock room to the lecture room without carrying it around through the door. In chemistry rooms a fume hood may be built behind the lecture table, opening through the wall by sliding windows into the lecture room on one side and the stock room on the other. Such a fume hood may serve also as a convenient slide through which to pass apparatus. The demonstration table has already been described. In addition to this the essential requisites are tablet chairs and blackboards.

Classroom chairs should be strong and light, and the tablet should be large enough to provide adequate writing surface (about 10 × 12 inches). In a standard classroom, 24 × 32 feet, there can be a maximum of forty-eight chairs arranged in eight rows of six chairs each from front to rear. This will leave space for aisles 2 feet wide next to the outer wall and down the middle of the room and a 4-foot aisle next to the inner wall, with plenty of room also at front and rear. If desired, one row of six chairs may be omitted and the narrower aisles widened accordingly. The small classrooms 24 × 21½ feet will have space for two rows of only three chairs each instead of six; and will therefore have a maximum capacity for twenty-four students instead of forty-eight.

In all classrooms, blackboards should extend along all available space on the front, rear, and inner side walls.

For every science there are some pieces of demonstration apparatus and exhibits that are very frequently used. For convenience in storing these near the demonstration table where they can be at hand for instant use, it is desirable to have a cabinet against the outer wall between the forward window
and the front wall of the classroom. Another convenience that should be provided is a light rectangular wooden rack made of flat strips of wood, and suspended at its two ends by cords and pulleys, so it can be adjusted to any height. This is for the purpose of displaying maps and charts, which are to be suspended from the horizontal strips of wood by means of stout wire hooks.

Another very desirable convenience in the science classroom is a rolling table 2½ feet wide, 3 to 4 feet long, and 2 feet 6 inches high. This is to serve as a means of transporting apparatus, especially large pieces like an air pump or a static electrical machine, from the apparatus room to the classroom. In the classroom this table may serve as a convenient extension to the lecture table. It should be mounted on rubber-tired ball-bearing casters so as to move easily and noiselessly, and should have a shelf underneath the top. Both this shelf and the top should have retaining rims to keep the apparatus from sliding off. At least one classroom should be furnished with a lantern screen on a spring roller at the front, and an adjustable lantern stand at the rear, for the projecting lantern.

X. APPARATUS AND STOCK ROOMS

The size of the room for demonstration apparatus in physics must be determined by the maximum amount of apparatus that is to be stored in it. It is a great mistake to make this room too small.

Unless, however, the school possesses an unusually large outfit, a half unit, or $24 \times 16$ feet, will provide ample floor space. The space along the front, rear, and inner side wall may be filled with apparatus cabinets; and a double cabinet 4 feet deep with all four sides of glass may be placed in the middle of the floor space parallel to the front and rear walls. A workbench, 3 feet high, 2 feet wide, and 8 feet long,
with a carpenter’s vise at the left end and a small anvil and vise for metal working at the other end, may be built in along the outer wall next to the windows. The space underneath the bench should be filled with drawers and cupboards to contain wood- and metal-working tools, soldering and glass-working outfit, and such supplies as screws, nails, screw hooks, screw eyes, binding posts, wire, and sheet metals. These are needed in making and repairing apparatus. A 2-foot section of this bench at the right-hand end should be left open for knee space so that one may work there sitting. Toe space must also be provided, at the floor.

For a combined supply and preparation room for chemistry a half-unit room is ample. The preparation table may be placed along the middle line of the room, or if that space is needed for additional cabinets for apparatus and supplies, it may be placed along the outer wall next to the windows.

For a supply room for middle school biology a $24 \times 10$ foot room is ample, but such a room is not large enough to provide space for museum specimens. It is better to provide a standard size or a 1½ unit room for a museum, with cabinets along the walls and show cases extending across the room parallel with the front and rear walls. If a single stock room is to house the equipment for two or more subjects (physics and chemistry, for example, or biology and general science), it must be a standard-sized room $24 \times 32$ feet. Physical apparatus must not be kept in a room where chemical experiments are made, on account of possible injury by corrosive fumes.
CHAPTER 20
APPARATUS AND EQUIPMENT

I. WHAT THE SCHOOLS HAVE

FUNDS were expended quite lavishly in the later years of the Ch'ing dynasty and the early years of the Republic to equip the middle schools, and more especially the normal and technical schools, with science apparatus. Unfortunately, however, the apparatus that was purchased for most of the schools was wholly such as is designed primarily for class demonstrations and experiments to be made before the students by the teachers. Excepting in a few colleges and technical schools and in a few exceptionally enterprising middle schools, there is little or no apparatus that is designed primarily for students to experiment with individually.

The demonstration apparatus, purchased mostly from Japan fifteen or twenty years ago, is of such a kind and variety as was commonly purchased from English or German apparatus factories by schools in America, not fifteen or twenty years ago, but forty or fifty years ago. Since that time great improvements have been made in the manufacture of apparatus in Germany and England and also in the United States, where more than a score of reliable apparatus houses have sprung up. These are manufacturing better and cheaper models of apparatus than existed anywhere forty or even twenty years ago. The most notable contribution of American manufactures has been in the line of apparatus and supplies for students to experiment with individually in the laboratory.

As a consequence of the extensive laboratory teaching movement in America which commenced about 1886,
and of the abundance of laboratory apparatus being manufactured, American schools are very generally well supplied with apparatus for individual laboratory experiments in physics and chemistry; and they have been so equipped at less cost than was formerly incurred to buy all the demonstration equipment that used to be considered essential. Chinese schools should have such equipment; and the sooner they get it the better for science teaching in China. They are now for the most part forty years behind the better American schools in equipment and methods of teaching. Demonstration equipment is necessary, but it is not so necessary as laboratory equipment. Laboratory apparatus enables the students themselves to make with relatively simple and inexpensive appliances, many of the experiments that were formerly made by the teachers with apparatus that was finely finished, highly polished, and unnecessarily heavy and expensive.

II. CONDITION

In our survey, we found that in many localities much of the demonstration apparatus that formerly existed has been lost or wholly destroyed. We were informed in a number of cases that this happened when soldiers were quartered in the schools during the first or the second revolution. In Chunking, Szechwan, where we were during the siege in October, 1923, we found soldiers quartered in most of the schools, and saw what havoc they can work in a school when they are not supposed to be looting it, but only living there. They would carry off and sell even the window glass, and use the sashes for firewood.

This, however, is not all. Much of the apparatus which was not broken or carried off at such times has been allowed, through the years, to deteriorate because of the lack of proper care. Much of it has become badly corroded, or is otherwise in very poor condition. In many of the schools, not only
have such things happened, but also the apparatus is kept in the cases in a mixed-up condition without any systematic or orderly arrangement. Furthermore, it was frequently found to be covered with the accumulated dust of months or even years.

In such cases, the first thing to do is to get out that part of the apparatus which is in good working order or can be put in good repair by the teacher or a local workman, and have it all cleaned up nicely and put in first-class working condition.

The next thing to do is to clean the cases thoroughly and have them repaired so as to make them dust-tight. If they cannot be so improved they should be replaced by new ones. All apparatus that is completely obsolete or so badly broken or corroded as to be useless should be removed to a junk room where parts of it may sometime be used in making other apparatus. *It should not be put back in the cases.*

Finally, the good apparatus should be put into cases, according to the order in which it is to be used in instruction. Every piece should be so placed that it can be quickly removed and replaced without breaking or disturbing other pieces. There should be "a place for everything, and everything in its place." *The science teachers should be held responsible for seeing to it that the apparatus is put in good order and condition and kept so.*

III. **Much of the Apparatus Defective in Construction**

Another unfortunate circumstance came to my attention in several provinces,—namely, that a very considerable portion of the apparatus which has been purchased in Japan and a greater proportion which has come from two or three different Chinese companies in Shanghai, is so badly constructed that it cannot be made to work. This is true of such instruments as air pumps, static electrical machines, electrosopes, resistance boxes, and many
other things. They look like good pieces of apparatus, but they do not work, and never can be made to work; because they were made by workmen and passed on by inspectors who are not sufficiently trained in science to know what should be expected of a given piece of apparatus.

I believe that this condition is due more to lack of knowledge as to what is required than to lack of good intentions on the part of the merchandise houses that have sold this apparatus; *yet the schools must protect themselves.* My advice, therefore, is that for the present when apparatus is to be purchased, it be bought from the United States, England, or Germany until the Chinese manufacturers shall have learned to make only apparatus of correct pattern and construction, such as will always do what it is designed to do when properly handled. Before they can be trusted, they must put themselves in a position to do as reputable American apparatus manufacturers do; namely, *to guarantee positively that every piece of apparatus they ship to purchasers is properly constructed and packed for shipment in such a manner that it will not be broken in transit, and therefore will work satisfactorily if manipulated according to directions.* Such a guarantee means that if the apparatus is not strictly as represented, it may be shipped back at the manufacturers’ expense, and a perfect piece will be sent to replace it, or the purchaser may have his money back, at his option.

IV. China Should Have Reliable Apparatus Houses

I regret the necessity of making this recommendation that apparatus be bought outside China, because I believe most firmly that substantial encouragement should be given to Chinese manufacturers to build up a good manufacturing and jobbing business in educational apparatus and supplies in China; and the way to encourage
them is to send them orders to fill. The best foundation of such a business, however, is reliability of the product. The methods of manufacture and sale must be such that when a school orders any article from the apparatus house, the school officers shall know to a certainty that they will get exactly what they order, and that it can be depended on with certainty to do exactly what it is expected to do. The dealer’s catalogue should describe each article precisely, and should guarantee to take the article back and return the purchase money in every case where the article fails to correspond exactly with the catalogue specifications.

If the Shanghai apparatus makers will put their manufacturing business on this basis of reliability and guarantee, and if also they will act as reliable jobbing houses for importing and selling on a similar basis those products of American, German, and English manufacturers which they have not the facilities for producing, then these apparatus houses in Shanghai will be able to render a very great and urgently needed service to scientific educators in China. Their apparatus business, now imperfectly conducted, represents the third greatest need in science education in China. The first need is better trained teachers; the second is more and better science textbooks, laboratory manuals, and reference books in Chinese; and the third is reliable apparatus, chemicals and biological supplies, maps, charts, models, etc., which can be sold at reasonable prices. These Shanghai business houses cannot supply the schools with teachers; but they can provide satisfactory textbooks, apparatus, and supplies if they will cooperate with leading science teachers and get their advice, and will devote themselves sincerely and assiduously to solving the problem. If they will do this, they can have more influence in advancing the status of science in China than any other agency, excepting only the institutions that train the teachers.

To put themselves in this position of higher service these Chinese manufacturers of apparatus must employ
experts in the different sciences to inspect and pass on the apparatus they turn out from their shops. These experts must be men who actually know all the qualities that the apparatus must have, and will inflexibly refuse to approve any piece of apparatus unless it be up to the proper specifications in every detail.

It would not be necessary to employ several scientists for full time. There are in Shanghai a number of competent scientists who could perform this work of inspection by giving part of their time. Apparatus for inspection and approval might be sent to them at the colleges where they are working, and much of it might be tested by advanced students under their supervision. Such professors are to be found in Shanghai Baptist College, St. John’s University, Tong Tai Technical College, the Franco-Chinese Institute, the Central Y. M. C. A., etc.

The East China Christian Educational Association has a Committee on Physics Teaching. This committee is planning to arrange for the manufacture in Shanghai of a laboratory outfit for middle school physics which they can recommend and guarantee. It is hoped that this committee can, within a year, arrange with some Shanghai firm to supply this equipment to the government schools which desire it, as well as to the missionary schools which this committee is specially organized to serve. The chairman of this committee is Mr. E. H. Cressy, 20 Museum Road, Shanghai.

V. MUSEUM SPECIMENS

When we pass from the apparatus for the teaching of physics and chemistry to that for teaching natural history, we find conditions are very similar. Evidently in the early days of the schools, generous sums were spent to purchase for each normal school a “complete set” of specimens constituting a synoptic or typical museum collection in zoölogy, botany, physiology, and mineralogy.
These collections included specimens from the principal orders and families of the plant and animal scales as well as numerous botanical and zoological charts and papier-mâché models of human anatomy, plant anatomy, vertebrate embryology, a human skeleton, a set of from two hundred to five hundred typical minerals and rocks, and a set of wire and wooden crystal models. In fact, if we might assume that all these specimens were correctly labeled, and all these charts and models were scientifically accurate presentations of the forms which they were supposed to illustrate, it would be just to say that on the average the demonstration and museum equipment of Chinese normal schools when first installed, was more generous than that provided in American normal schools. However, we find by observation and by inquiry among expert biologists, that much of the labeling of the specimens is unreliable; and that the charts and models are in most cases inferior Japanese imitations of standard German productions, or are still more inferior Chinese copies of Japanese imitations of German products. Furthermore, we find that very, very little use is ever made of this material by the biology teachers, who usually do not know whether the labels are correct or incorrect, nor whether the specimens are good or bad; and they do not know how to make use of them in teaching. It is the exception, not the rule, to find such material being used intelligently in teaching;—for the teachers have been trained to book and lecture knowledge and not to knowledge of specimens in the field and laboratory. The collection is usually kept locked up in a room which in the majority of cases is very seldom opened for any purpose other than to exhibit the equipment to visitors or inspectors.

This being the case, it is not surprising often to find these specimens in a state of disorganization and disorder, and not infrequently to find them mouse-eaten and moth-eaten to such an extent that they are utterly ruined and most disgusting to look at. Such specimens
should be discarded and removed from the premises.

As has been advised in the case of physics and chemistry, the biology teachers should be held responsible for seeing that all the equipment is put into as good condition as possible, and arranged in order, and that the specimen cabinets be rebuilt or repaired or replaced by new ones, so that the specimens may not easily get into bad condition again. They should also be required to sort out, from the good specimens, those which are utterly spoiled, and have them taken away and destroyed. Then they should see that the specimens which are well preserved be cleaned up and arranged in the cases according to a systematic plan, and that all lost labels be properly replaced. In this work they should interest the students and get them to help.

It would be well to keep these specimens in securely locked cases, and place them in a room to which the students might have access, so that they might view them often and become familiar with them. *Even a small museum, if systematic, orderly, and attractive, is a great stimulus to scientific interest.*

### VI. Laboratory Apparatus Is Wanting and Should Be Supplied

Now the kind of equipment that we have described, although it is useful in a school as demonstration material to be shown in classroom lessons, and is also useful as museum material for the purpose of arousing and fostering interest, is mostly not such as can be used for individual students’ laboratory study in these subjects.

*In summing up for the other schools* we may say that the equipment in many of the technical schools and colleges is more extensive than that described as characteristic of the normal schools. Also the universities and some of the colleges and technical schools have very good laboratory equipments for college work.

On the other hand, it may be said that the equipments
of the middle schools in the various sciences resemble those of the normal schools; but they are much more limited as to types of apparatus and museum specimens that are represented in them.

As to condition, these equipments also vary from very poor to very good. Naturally we should expect to find the equipment in the best condition in those schools (1) whose general administration is conducted most efficiently, and (2) whose science teachers are most able and most enthusiastic about their work. In fact, this is just what we do find.

Now our recommendations must not stop with urging that the equipment already on hand be put in good condition and be utilized to the fullest extent of its educational value. Most emphatically that should be done, and should be begun immediately; but it is further recommended with all possible emphasis that the schools be equipped as promptly as possible with apparatus materials, and supplies for individual laboratory work by the students.

If there should not be enough money to equip all the schools, let one or two schools in each city be equipped in model fashion. Then let the others be furnished with the things that are most necessary and oftenest used, such as balances and weights, meter sticks, etc., and while in physics, for example, one school is studying heat, let another study electricity, another sound, and another light. Then the equipment for mechanics can be used by the first school while the second uses the equipment for heat, and so on. They can take turns in using the equipments for the various parts of the subject until at the end of the year each school will have used all the equipment. This of course will be a far less efficient plan than to have full equipments for all the schools; but it would be far better than no plan at all. With this plan, of course, each school would have to be made responsible completely for returning each lot of apparatus in good condition after it had finished using it.
VII. How to Select Laboratory Equipment

The proper way to select laboratory equipment is (1) to make a syllabus of the topics to be taught in the course; (2) to make a list of the experiments through which these topics are to be taught; (3) to determine which experiments shall be made by the teacher at the demonstration table and which shall be made by the students in the laboratory; (4) when the list of the laboratory experiments has been determined, make a list of the apparatus and supplies required for each experiment; (5) for each experiment order as many outfits as there are to be pupils working in a section (say twenty-four outfits) and also order an extra supply of things that will be used up—such as wire, sheet metal, chemicals, etc. The amount of apparatus may of course be reduced in the case of the more costly pieces by ordering one for each two, or each three, or each four students, and having the students use these in groups of two or three or four working together, or have them used in rotation or succession, thus having two, three, or four different experiments going on at the same time.

By means of the group plan, or the rotation plan, or a combination of both, the necessary multiplication of the apparatus outfits is much reduced; but the difficulty of managing and instructing the students while at work is very much increased; and also it is more difficult to maintain that close correlation between the class recitations and the laboratory work which is demanded by the principles of good pedagogy.

VIII. Help and Self-Help on Apparatus Problems

The Chinese National Association for the Advancement of Education is organizing a department of science teaching, for the purpose of helping the middle school teachers with their problems of making and selecting suitable
textbooks, apparatus, and so on. There will be a division of this department for each of the school sciences. It is hoped that these divisions, through their chairman and secretaries, will be able within the next year to furnish lists of experiments and of apparatus for each of the sciences, with helpful suggestions as to how best to obtain and use it. This, however, will take some time.

Hence it is recommended that in the meantime the teachers in each city be asked by the Commissioner of Education to meet and form a science teachers' club; and that each club be requested to undertake the project of formulating such a list of experiments and apparatus for each subject, using the best of such information that they have at hand. These lists, when completed and revised by the club, may then be submitted for criticism to the professors in some neighboring university who have had foreign training and experience, and who therefore can give reliable information on the difficult questions involved in the selection or making of apparatus.

It will be better to ask for a small appropriation each year, instead of trying to get a complete outfit in one order. In this way, the selection will be more carefully and wisely made; and there will be less likelihood that anything will be purchased which will afterwards have to be discarded because it proves to be ill adapted to the educational needs in the school.

IX. HOMEMADE APPARATUS

Much apparatus may be of very simple construction, and can be made by a teacher who has some skill with tools; or it can be made under his direction by local mechanics. Much of the apparatus in some American school laboratories is "homemade"; and American science teachers are expected to have the mechanical skill to plan and make such apparatus, and also to make simple repairs on apparatus that becomes broken. *College courses for science teachers ought to include instruction*
in such work, and in the collection mounting and identification of biological specimens, minerals, rocks, etc.

Some homemade apparatus was found in a number of the schools that were visited. If some of the teachers can succeed thus in supplying deficiencies in their equipments, others can do the same.

Homemade apparatus, however, like other apparatus, should be made to use. I have seen some, both home-made and factory-made, that seemed to be kept for no other purpose than to exhibit to visitors and inspectors.
CHAPTER 21

THE NORMAL SCHOOLS

I. CHARACTER AND DISTRIBUTION

The normal school in China corresponds to the middle schools or to the American high schools in grade. Under the first republican school code, these schools were reorganized so as to have one preparatory year, corresponding to grade 8, and a four-year normal school proper corresponding to grades 9 to 12.

In order to be admitted for examination, a candidate for entrance must possess a sound body and a reputation for good conduct. He must have the recommendation of the highest civil official in his county, and the guarantee of a responsible citizen. Having passed the examination, he enters the preparatory grade; and after four months’ probation, if he qualifies he is accepted as a regular student. If he passes successfully through the five years’ curriculum and also passes the graduation examination, he receives a certificate entitling him to teach in elementary schools.

Whereas students in the middle schools have to pay a small fee covering their board and part of their tuition cost, the normal school students are not required to pay anything. In some of the normal schools they get even their books and school supplies free of charge. In return for this, they are obliged to sign a contract to teach for a period of seven, five, or three years according to whether they are on full or half scholarships or are paying board and tuition as private students.

Adopting the 6-3-3 plan.

Under the 1922 reorganization code the normal schools, like the middle schools, are to be reorganized on the 6-3-3 plan,
including grades 7 to 12. The Junior Department includes grades 7 to 9, and the Senior Department, grades 10 to 12. Graduates of junior middle schools having taken and passed a course on "Introduction to Education" are to be admitted to the Senior Department of the normal school. The Junior Department is nearly identical with the junior middle school. The Senior Department is the normal school proper, having a curriculum including professional courses. The normal schools, like the middle schools, are to change to the new plan.

The normal schools are widely distributed over twenty-six different provinces and administrative districts in numbers varying from one per province or district up to twenty-two for Fengtien, and twenty-three for Chihli (exclusive of the Peking District, which has four). There is a total of 275 schools with an aggregate enrollment of 38,277 students. Two hundred eight are boys' schools with 31,533 enrolled; and 67 are girls' schools with 6,724 enrolled. The number of boy students per school is 152 and the number of girl students per school is 100. The province having the largest average number of students per school is Shansi, with 246. And those having the smallest average are: Kansu, 59; Chahar, 76; Sinkiang, 85; Suiyuan, 87; and Kwangtung, 88. These latter, excepting Kwangtung, are sparsely populated.

The number of pupils per teacher and officer for the whole country is 8.5, and this ratio ranges in the provinces from 13.6 (Kirin) down to 6.1 (Kwangtung). The small numbers of pupils per school and per teacher in general increase the costs per pupil without necessarily increasing educational efficiency. This leads to the suggestion that money might be saved and expended for libraries, apparatus, better salaries, and other things that actually contribute to educational efficiency, if some of the normal schools could be consolidated with middle schools existing in the same communities.

The possibilities of making one adequately financed and efficient school by combining two or more impoverished and
inefficient schools should be carefully considered by the authorities of every province.

II. Cost of Normal School Education

The country-wide average cost per student per year for education in the normal schools is $116.37 as against $63.84 for middle schools.¹ This means that on the average, it costs the people eighty-three per cent more to put a student through a normal school than it costs to put one through a middle school.

I have not been able to find in the schools any sufficient general reason for this difference in cost. Certainly the quality of education in the normal schools, as shown in teaching, buildings, and equipment, does not stand out from that of the middle schools as very greatly superior. It may be from ten to twenty per cent better; but certainly it is not eighty-three per cent better. The salaries are a little higher; but apparently not enough higher to nearly double the quality of teaching. The number of students per teacher is smaller (8.5 as against 11.1) but not enough smaller to account for the difference in costs. Nor, as a result of the smaller classes, do the normal school pupils seem to receive more individual attention from teachers than the middle school pupils do.

It seems, then, that normal school education costs more than middle school education, although it is of the same grade; that the facilities afforded are not better in proportion to the greater cost; and that the higher salaries and smaller classes in the normal schools are not sufficient to account for the difference in cost. It looks as if the normal schools on the average were less efficiently and economically managed than the middle schools. Are they?

¹ The statistics, used up to this point, were gathered by the Statistical Department of the Chinese National Association for the Advancement of Education. They are taken from Shueh, H. T., Bulletin 16, 1923, and from Chu, Dr. J. P., “Normal School Education in China,” Bulletin 11, 1923.
I do not know; but this is a question that can be answered by a careful special survey. Such a survey of the normal schools, if thoroughly and courageously carried out, would make a very important contribution to education in China. From what I have been able to see in the two types of schools, my conviction is that the wisest policy would be to consolidate normal schools with middle schools wherever institutions of these two types exist near together. This policy would make for greater educational efficiency and great fiscal economy in both kinds of education, provided of course that only the most efficient, devoted, and enlightened educators and managers were placed in charge of such united schools.

III. THE NORMAL SCHOOL STUDENTS AND TEACHERS

In my visits in the normal schools I could see no common characteristics of the students that distinguished them as a class from those in the middle schools.

As to the teachers, their average age, experience, and teaching skill seemed to be a little above that of the middle school teachers; but there were many exceptions. The accompanying table (page 327) shows for forty-seven normal school teachers, who answered the questionnaire, how many teachers (column 6) have had each of the amounts of training indicated at the left of the line (column 1). It also shows how many of those with each amount of training received their highest training in a higher normal, a college, or a university (columns 3, 4, and 5). It will be observed that none have reported training in middle school or normal school only; and 36 or 76.6 per cent are products of the higher normal schools with training above elementary school ranging from three up to ten years. Graduates of colleges and technical schools constitute 12.8 per cent and graduates of universities 10.6 per cent. The corresponding percentages for the middle school teachers are,—middle schools only, 3.7 per cent; higher normal schools, 54.4 per cent;
DISTRIBUTION OF 40 SCIENCE TEACHERS IN BOYS' NORMAL SCHOOLS AND 7 IN GIRLS' NORMAL SCHOOLS ACCORDING TO THE NUMBER OF YEARS OF THEIR TRAINING ABOVE ELEMENTARY SCHOOLS, AND ACCORDING TO THE KIND OF INSTITUTION IN WHICH THEY RECEIVED THEIR HIGHEST TRAINING

<table>
<thead>
<tr>
<th>KIND OF INSTITUTION</th>
<th>YEARS OF TRAINING</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIDDLE OR NORMAL SCHOOL ONLY</td>
<td>HIGHER NORMAL OR TEACHERS COLLEGE</td>
<td>COLLEGE OR TECHNICAL INSTITUTION</td>
<td>UNIVERSITY</td>
<td>ALL</td>
</tr>
<tr>
<td>Less than 3</td>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3 up to 4</td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>4 ,, 5</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5 ,, 6</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>6 ,, 7</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>7 ,, 8</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>8 ,, 9</td>
<td></td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>9 ,, 10</td>
<td></td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>10 ,, 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>11 or more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>36</td>
<td>6</td>
<td>5</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td><strong>Percentages</strong></td>
<td></td>
<td>76.6</td>
<td>12.8</td>
<td>10.6</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

colleges and technical schools, 19.8 per cent; and universities 22.1 per cent.

As far, then, as those who answered the questionnaire are typical of the two groups, we may say that the normal schools tend to select a larger proportion of their teachers from among graduates of the higher normal schools than the middle schools do; and they select a smaller proportion of their teachers from the colleges, technical schools, and universities.

Normal schools select more higher normal graduates as teachers.

It indicates that since normal school teachers are drawn in largest proportion from their graduates, the higher normals ought to pay close attention to the problem of training teachers for the normal school work. They should consider very carefully the problems of elementary teaching because their graduates will be the trainers of elementary teachers.
The median number of years of training above elementary schools reported by the normal teachers is 8.53 as compared with 8.25 for the middle school teachers. This difference is not great enough to be significant.

One teacher reports holding the B. A. degree from the National Peking University, and one the M. S. from the University of Manchester, England. Three others report that they hold diplomas from higher normal colleges. All of the others report holding certificates, excepting seven who made no report on this item.

The teachers report attendance at the following universities and colleges, each one in the list being named by one teacher only: National Peking University; Shansi University; Pei Yang University; University of the Philippines; University of Manchester, England; Peking Industrial College; Chihli Technical College; Shanghai Technical College; and Tengchow College. Total, 9.

The higher normal schools that were attended by teachers who answered, together with the number of teachers reporting attendance at each, are named below:

National Peking Teachers College, 11; Chihli Higher Normal College, 5; Shen Yang Higher Normal, 5; Wuchang Higher Normal, 3; Liang Kiang Higher Normal, 3; Tsao Tao Tien Higher Normal, Japan, 1; Fengtien Higher Normal, 1; Nanking Teachers' College, 1; Kiangsi Higher Normal, 1; and Pei Yang Higher Normal, 1. Number of higher normals named, 10; number of teachers reporting attendance, 32.

The accompanying table (page 329) shows the distribution of thirty-eight teachers in boys' normals and seven in girls' normals who answered on these items of the questionnaire. They are distributed according to the total number of years they have taught (column 2) and according to the number of years they have taught in the school where now serving (column 3).
### DISTRIBUTION OF NORMAL SCHOOL TEACHERS ACCORDING TO TOTAL YEARS OF SERVICE, AND ACCORDING TO YEARS OF SERVICE IN THE SCHOOLS WHERE THEY ARE NOW TEACHING

<table>
<thead>
<tr>
<th>NUMBERS OF YEARS OF SERVICE</th>
<th>NUMBERS REPORTING THESE AMOUNTS TOTAL SERVICE</th>
<th>NUMBERS REPORTING THESE AMOUNTS IN THEIR PRESENT SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 up to 1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>20 or more</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Answering</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Not Answering</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Medians</td>
<td>5.9</td>
<td>2.3</td>
</tr>
</tbody>
</table>

The median total service is 5.9 years and the median service in the schools they are now serving is 2.3 years. There is no distinctive mode for total service; but the teachers are largely bunched in the terms of relatively short service, two thirds having taught less than nine years. The mode for service in their present schools is zero up to one year and two thirds have been with these schools for less than three years. These figures do not tend to confirm my impressions from the field, that the normal school teachers in general are more mature and experienced than the middle school teachers. For
the latter, the medians are 6.2 and 2.6 years, respectively, both of them slightly more than the corresponding medians for the normal school teachers. Possibly the disagreement may result from the condition that the forty-seven normal school teachers who answered the questionnaire, are mostly those who have recently graduated from the higher institutions and are therefore more familiar with questionnaires and also less disinclined to supply statistical information. If so, the older teachers may not affect the questionnaire data but may still be the prevailing element in the normal schools.

The obvious conclusion concerning those of the two groups who will answer a questionnaire, then, is that there is no discernible difference between them as to experience. If there be any between the two kinds of schools it will take much more complete statistical data to determine it. At any rate, these data indicate short terms of service and rapid shifting of positions among those who may be presumed to be the most active and enterprising teachers in both types of schools. This is just what experience with schools would lead one to expect where teachers are poorly and irregularly paid, as is known to be the case in the government schools. It is a condition which is not good for either teachers or schools.

The annexed table (page 331) from the questionnaire data shows how the normal teachers are distributed with reference to the annual salaries which they report receiving from the schools in connection with which they answered the questionnaire, and also with reference to the total amounts received annually for all teaching work. Only thirty-one teachers out of forty-seven answered.

It will be seen that the mode is $700 to $800 for both columns 2 and 3. For the middle schools and column 2 there are two modes—at $600 to $700 and at $400 to $500. The middle school mode for column 3 is $600 to 700.

The medians for the normal schools are $691.67 for column 2, and $738.89. The corresponding medians for
### Distribution of 27 Teachers in Boys' Normals and 4 Teachers in Girls' Normals, According to Their Salaries in Their Schools and According to Their Total Teaching Incomes

<table>
<thead>
<tr>
<th>Amounts Received Annually in Chinese Dollars</th>
<th>Members Receiving These Amounts From Their Schools</th>
<th>Numbers Receiving These Amounts Total Teaching Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 up to 200</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>200 &quot; &quot; 300</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>300 &quot; &quot; 400</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>400 &quot; &quot; 500</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>500 &quot; &quot; 600</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>600 &quot; &quot; 700</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>700 &quot; &quot; 800</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>800 &quot; &quot; 900</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>900 &quot; &quot; 1,000</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1,000 &quot; &quot; 1,100</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1,100 &quot; &quot; 1,200</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1,200 &quot; &quot; 1,300</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1,300 &quot; &quot; or more</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Answering</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Not Answering</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Modes</td>
<td>$700–$800</td>
<td>$700–$800</td>
</tr>
<tr>
<td>Medians</td>
<td>$691.67</td>
<td>$738.89</td>
</tr>
</tbody>
</table>

The middle schools are $612.50 and $625. These latter are based on 82 answers out of 136 reporting. So far as the teachers in each group who reported may be typical, these figures indicate that the tendency is for the normal school teachers to receive from ten per cent to fifteen per cent more than the middle school teachers receive.

**IV. Curriculums**

The accompanying table (page 332), taken from Dr. Chu's bulletin, shows the normal school curriculum as promulgated by the Republican government in 1912.

This shows some advance over that previously in force since 1903. It reduces the time given to study of Chinese old classics from nine hours a week for five years
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PREPARATORY DEPARTMENT</th>
<th>NORMAL PROPER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FIRST YEAR</td>
<td>SECOND YEAR</td>
</tr>
<tr>
<td>Ethics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Classics</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Chinese</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Handwriting</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>History</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Geography</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Physical and Chemistry</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Political Science and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawing and Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physical Exercise</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td><strong>34</strong></td>
</tr>
</tbody>
</table>

down to two hours a week for four years. The time given to "education" also is reduced, but nine hours of practice teaching are introduced. Mathematics is given more time and "political science and economics" (two hours) is added. So also are manual training and agriculture. The introduction of foreign language also represents a change. These changes, however, have done relatively very little towards a real vitalizing of the curriculum, or toward making it a selection of the most necessary training for teaching in the elementary schools.

1. For example, only very few normal students, at most, will have any occasion to use or teach a foreign language, and even the few that do so cannot get enough training in it in a normal school to fit them to teach it successfully. Then why compel any
normal school student to study a foreign language? If it be taught at all, it should be as an elective.

2. Too much time proportionally is given to mathematics: five hours a week for two years of composite or junior high school mathematics would be enough and more than is necessary.

3. History and civics get too small a proportion of the time. Certainly not less than the equivalent of five hours a week for two years should be given to these social studies and to methods of teaching them in elementary schools. They are too important for citizenship to be compressed in order to make room for mathematics and foreign language.

4. Nothing worth while can be done on such profound subjects as economics and political science in two hours a week for one year. If this time be transferred to civics and history these subjects might be helped and vitalized for citizenship by introducing in connection with them a few principles of economics and sociology. The principles chosen should be (a) those which can be presented most simply, and (b) those which are most necessary for every citizen to understand.

5. The time is given to the physical and natural sciences is about right, but might be better distributed in the new 6–3–3 curriculum when this is put in force.

The Kiangsu Normal Principals and Deans in November, 1922, adopted a new curriculum to be put in force in that province. It also seems to me to be not quite satisfactory, since (1) it requires a foreign language, and (2) also mathematics beyond what is needed. It gives (3) more time than ought to be given to physics and chemistry and (4) not so much as ought to be given to biological science, nature study, and methods of teaching nature study. Finally, (5) it gives no time in the Senior Department to the study of history, and civic problems.

The Anhwei Department of Education (April, 1923) has made an attempt also to work out a solution of the problem of curriculum improvement.
### Anhwei Department of Education—Normal School Curriculum

<table>
<thead>
<tr>
<th>COURSES (which need preparation)</th>
<th>FIRST YEAR</th>
<th></th>
<th>SECOND YEAR</th>
<th></th>
<th>THIRD YEAR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Term</td>
<td>Hours per Week</td>
<td>Second Term</td>
<td>Hours per Week</td>
<td>First Term</td>
<td>Hours per Week</td>
</tr>
<tr>
<td>Civics</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chinese</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>English</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Biology</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal and School Hygiene</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Library Management</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Psychology</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics and Chemistry</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice Teaching</td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kindergarten</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Principles and History of Education</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Administration and System</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Psychology</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocational Problems for Elementary Children</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Training</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching of Chinese</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of Teaching</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom Management</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Measurement</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Mathematics and its Method of Teaching</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal School Geography and History</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Physics and Chemistry</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary School Curriculum</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
In this scheme, which is shown in the accompanying table (page 334), Chinese is carried only through the first of the three years of the senior school, while English is required in all. (1) In my judgment, the Chinese has been too far reduced, and (2) the English ought not to be required at all. (3) Mathematics is reduced to "general mathematics and its methods of teaching," three periods a week for a half year. If this means mathematics for the elementary schools with emphasis on teaching methods, this change is a good one. (4) The time given to history seems to me inadequate for getting a satisfactory basis of scholarship for an elementary school teacher in that line. (5) The sciences are not given adequate time for thorough grounding in the subject matter and sufficient instruction in methods of teaching nature study in the elementary grades. (6) The same is true of geography. (7) There are more kinds and a greater amount of the so-called professional subjects than students of middle school age and development can handle intelligently.

I fear that the students who follow this curriculum will get a smattering of a wide range of technical studies in education, and will lack the elements of a sound general training which is essential for every intelligent citizen,—especially a teacher of youth. The essential professional subjects for an elementary teacher, in my judgment, are:

1. Elementary psychology with some laboratory experiments, and covering those phases of psychology only which are necessary for the elementary teacher to know. One year, five periods a week.

A good deal of the psychology of learning and thinking should be included—a little of instincts, child psychology and the principles of child study, a little about fatigue, a little of the psychology of sound, light, and color, a little of individual differences, and a little about emotions, and motivation.

2. Class management and methods of teaching the elementary subjects. One year, five hours a week.
This should cover methods in one or two subjects carefully, and should include applications of the general principles of teaching to the other elementary subjects both by way of getting a concrete basis for teaching the general principles and as a means of enlightening the students by typical examples as to just how to teach these particular subjects. Pedagogy, after all, is nothing but psychology and common sense applied to the teaching problems that the teacher meets in his daily contact with his pupils in their learning in the different subjects.

3. Observation of teaching and practice teaching. Five hours a week for one semester.

This is quite enough for a normal school student of middle school grade to master; and it all will have to be very much simpler than it is as taught in universities and normal schools of college grade. Further professional knowledge should be sought by the elementary teacher in collegiate classes and summer institutes after he has had some practical experience and is better able to acquire it and appreciate its value. Such subjects as school administration and systems, history of education, principles of education, “elementary school curriculum,” and educational psychology are college subjects, and should not be attempted in schools of middle grade. The first two especially would better be reserved for university or college postgraduate study.

Chapter 17 of this book contains discussion of curriculum problems for schools of middle grade, together with carefully planned and balanced curriculums for different groups of students having different aims and interests. One of these is for students of the normal department of a comprehensive high school, containing departments for college preparation, industrial, commercial, agricultural, home economics, and normal education. The normal curriculum as outlined is suitable for separate normal schools. It is recommended to normal school administrators and teachers
for careful consideration and discussion. The entire chapter should be carefully reviewed in connection with the curriculum proposals here discussed. It is hoped that the suggestions contained in the two chapters will help in the final shaping up of a curriculum for the normal schools, that will be vitalized, workable, and better balanced than those which now exist.

V. ROOMS AND EQUIPMENT

The rooms and equipment, as well as the methods of teaching in the normal schools, are so much like those already described and discussed in connection with the middle schools that no additional comments on these features are necessary. Chapters 13 to 20 will be found in general to apply as faithfully to normal school conditions as to those of the middle schools. All normal educators who have not read them are therefore advised to do so.
CHAPTER 22

THE TRAINING OF TEACHERS FOR SCIENCE

I. THE CONTROLLING FACTOR IN SCIENTIFIC DEVELOPMENT

In the great problem of scientific development in China, the science teachers constitute the most important factor. Knowledge of science, skill in the use of the scientific method, and ability to apply scientific discoveries and inventions to human needs, can come in large measure only through scientific instruction widely disseminated. Only rare geniuses can acquire the ability to make discoveries and inventions through self-training. Others who are not so highly gifted must go through a course of instruction under teachers who themselves understand the scientific experimental method of study, who know the facts and the principles of the sciences, and who also know how to teach them.

In the various chapters of this report and in many different ways, it has been shown that China, as yet, is behind the times in scientific development, but that her leaders and thinkers regard widespread scientific knowledge as essential to the progress of the people and the safety of the country. As yet, however, there are relatively very few well trained and highly competent scientists at work in the country.

Also, although science, from the very beginning of the Chinese modern school system, has had a prominent
place in the curriculums of all grades and kinds of schools (excepting only the commercial schools) yet observation in the schools reveals the fact that in a large majority of them the methods of teaching and the types of equipment are such that the students are not getting real scientific training. The instruction that they are receiving, for the most part, is not the kind that will give them adequate conceptions of the facts and principles of science, or make them competent to apply their book-and-lecture lessons to practical uses.

The ways in which the teachers are failing have been set forth specifically in Chapters 15 and 16 of this volume; and the judgment has been expressed that their failures are not due to lack of ability or of open-mindedness or of desire to improve; but that it is due almost entirely to the fact that they themselves, through no fault of their own, have not had the fortunate privilege of going through an effective course of scientific training. The result is that (1) many both in the scientific method and in the pedagogy of science.

Substantial improvement can come only through the initiative of the teachers themselves.

Every improvement in teaching practice must come through the individual acts of the teachers themselves. Also, nearly every improvement in the equipment and facilities for teaching must come through individual initiative, effort, and agitation from the science teachers themselves.

From this line of reasoning two of the most important conclusions of this entire study become obvious.
1. The whole problem of immediate improvement in the teaching of science depends on setting-up agencies, facilities, and organization, for training the teachers now in service, and for helping them while they are at work by placing within their reach information that will enable them to help themselves.

2. The whole problem of ultimate improvement depends on properly training prospective teachers who are now attending the middle schools, normal schools, higher normals, and colleges and universities. These must be given real, exact, thorough scientific training in experimenting, observing, and reasoning to conclusions on significant scientific problems. Instruction and training in the proper methods of teaching, and the proper methods of collecting, maintaining, and using scientific teaching equipment must also be given them. This training ought to begin with a systematic program of observation and nature study in the lower schools, beginning with the kindergarten and extending through every grade.

It ought to be continued with steadily increasing thoroughness and exactitude through the junior and senior middle schools in accordance with the methods and principles outlined in Chapters 13–17 of this volume.

It ought to include more mature and intensive study of both the sciences themselves and the improved methods of teaching them, in the colleges and universities.

For nearly a generation the higher institutions will have a pioneer job; because the students that come to them as possible future teachers of science will not have gained in the elementary and middle schools the thorough training that is necessary as a foundation for the kind of intensive scientific study that they should carry on in college. It will be necessary, therefore, for the colleges to adapt their plans of instruction to the necessities of a body of students who are lacking in this thorough
They must adapt their courses and methods foundation of elementary science training which should be laid in the lower and middle schools. What was learned by observation and inquiry of the Chinese-controlled higher institutions that were visited, has convinced me that the teachers and administrators of these institutions have not come sufficiently to a realization of the necessity that exists of adapting their courses so as to take account of this deficiency in fundamental scientific training in the students who come to them.

These students are not only deficient in knowledge of the elementary scientific facts and theories, but they are also lacking in the habits of accuracy, the ideals of thoroughness and exactitude, and the appreciation of careful and methodical observation, experimenting, and thinking, that are the very essence and foundation of scientific study. Furthermore, they lack this knowledge and these qualities to such an extent that they are not even aware of their deficiencies. They do not even guess that their preparation for college work in science is inadequate. The consequence is that they want to start in at once with something very advanced and abstruse in science and are not willing to get down to hard study and hard work on the elementary and fundamental things that they must first thoroughly master before they can successfully pursue the higher college courses in science. They want to study big, thick books, full of mathematical equations and abstract theories; and they look down with scorn on elementary textbooks and courses which they suppose themselves to know but do not know.

So they insist on advanced lessons; and the teachers and administration yield to them. They listen to abstruse and abstract lectures, which they cannot understand because they lack the fundamental knowledge which is prerequisite to complete mastery of them; and they put the blame for their failures upon the shoulders of
the teachers. In consequence, they dread the examinations and use every device to evade them that human ingenuity can think up. Hence, strikes, absences, applications for leaves of absence, illnesses, etc., are very common about examination time.

This situation could be remedied in the first college year, and a good foundation for the work of the later years could be laid, if the college teachers would face it squarely and adopt their courses and their teaching to it.

1. First they should go over their courses carefully and eliminate the most abstract and difficult portions. They should then select the fundamental facts, ideas, and methods upon which success in mastering the higher and more difficult subject matters and methods depends. These fundamentals they should mark for thorough study and testing.

2. In approaching each new division of the course they should review those fundamentals which are prerequisite to mastery of the higher things in that division of the subject, explain to the students the necessity of mastering them before proceeding further, and make sure by questioning and testing that these fundamentals are thoroughly known and mastered by not less than ninety per cent of the students in the class. Then, and not until then, it will be wise to go on with the more advanced subject matter in that division of the course.

3. In the preliminary review of the fundamentals, and throughout the teaching of the more advanced principles in every division of the subject, the same system of careful explanation, skillful and logical questioning, and short but searching written tests should be used. Too many of us college and university teachers go on lecturing week after week without testing as we go along. When we read the students’
examination papers at the end of the term, we are surprised and vexed to find out from their answers how imperfect their grasp is on the essential points about which we have been talking so grandly! When will we learn to attempt to teach less, and teach it better? When will we come to admit that it is better for the students to know thoroughly a few essentials than to hear about or read about a lot of things which they promptly forget, or remember so vaguely that they cannot make any use of them?

4. In every beginning course in science, laboratory practice carefully supervised should be an essential part. The laboratory experiments should be closely correlated with the work of the classroom. Either in the laboratory or in the classroom, the students should be quizzed about the experiment and its relations to the facts and principles being learned in the classroom. The teacher should make certain that the work is thoroughly, accurately, and honestly done, that the notes are systematically and honestly written up, and that the students understand the significance of the experiment in relation to the principles to be taught.

If the college science teachers who are returned students from Western colleges, and who entered as freshmen will review their own experiences as students, doubtless they will be able to recall the effects on them of freshman or sophomore courses taken under teachers who conducted their instruction in accordance with the four principles just laid down. Perhaps, also, they can recall other courses in which the teacher lectured all the time and gave a fierce examination at the end of the term, and in which also the connection between the laboratory work and the class instruction was not made clear and intimate. If so, they may compare the quality of the knowledge gained under instruction of the first kind with that gained under instruction of the
second kind, and will be able to recall how much better the former is than the latter.

Only the *good* methods of college and university teaching should be imported from the West.

It should be remembered also that college courses in China *must* for many years be of less advanced grade than courses in the same year of the college curriculum in the West; because the foundation work in the middle schools of China is not so well done as it is in the Western middle schools.

On the other hand, it should be borne in mind that in point of thoroughness and skill in their own work of instruction they should try to do better than was done by them. They should strive to equal or excel the work done in Western colleges, not in the *difficulty* of the work required of their students but in the *thoroughness* with which the minimum essentials of the work are mastered. In the latter objective, if they will, they may easily excel.

**II. A Broader Conception of Teaching Aims**

Concerning the missionary colleges, it may be said that in general they have a better understanding of the limitations that are imposed upon their teaching by the defective college preparation of their students. They adapt their freshman courses better to the abilities of their entrants as these abilities actually are. Also they are more careful to exact thorough work from their students. Nevertheless the mission colleges share with the government and private colleges in what appears to be the lack of a broad and certain grasp on the relation of their work to the problem of scientific development in China. *It is characteristic of all these higher institutions, to a greater or less extent, that their teachers are centering their efforts more on teaching their special sciences than on training men and women both broadly and intensively for science teaching and for practical scientific work.*
course there are notable exceptions in several colleges, and in various departments. What is much needed, it seems to me, is a careful coöperative study, by the faculty of every institution, of conditions as they now exist, and of trends and tendencies towards future conditions, in the social, economic, and educational fields. The purpose of such coöperative studies and deliberations should be to determine what kinds of trained workers and leaders are needed to meet present demands, and also to meet the developing and expanding demands that will come along within the next twenty or thirty years. *It must not be forgotten that these college students will by that time be the chief constructive thinkers of China.* What China ought to get from these colleges is a body of graduates so trained that they are habitually thinking of what they can do for their distressed and disorganized country in terms of a *fruitful life service,* and who care not at all for a life of wealth and ease. The trouble with China and the whole world to-day is that too many of its most capable inhabitants are striving to get *out* of the earth and their fellow men all that they possibly can for their own personal pleasure and aggrandizement. Instead, they ought to be striving to put all they can *into* the world and society for the betterment of all classes of the human brotherhood.

It is better to serve than to be served. Effective service always brings its own rewards, which are better than rewards that are sought as ends in themselves. Too many of the students to-day in both the Orient and the Occident are seeking education as an *end in itself* or as a means or gaining *personal* wealth, power, and pleasure. Instead, they ought to be seeking it as an *equipment for a life of service.*

If this philosophy of life as service shall be made the basis of educational policy, accepted by faculties and
Education for service in the new China!

students alike, the problem of education in each institution resolves itself into three questions—(1) What are the kinds of service most urgently needed? (2) What sort of education and training is needed for each of these kinds of service? (3) With the personnel and equipment available to this institution, which of these kinds of training can the institution undertake and do well?

Having made a decision on the last of these points, each institution should address itself whole-heartedly to giving those sorts of training that it can carry on efficiently. Coöperative attention should be given by all the colleges to see that all the most needed kinds of training are given, each kind being attempted only by those colleges that are best equipped for offering it.

The National Peking University and the National Southeastern University, with their larger staffs, more varied equipments, and facilities for advanced courses, are the logical centers for the training of experts for government service and teachers for other colleges; but also they will always take a large part in the training of middle school teachers.

Training in preparation for industrial service in the manufacture of silk and cotton fabrics is being given by a number of government technical schools and colleges, training in mining and civil engineering by Peiyang and Nanyang universities, training in mechanical engineering by the two technical colleges in Shanghai and Woosung, and training for scientific agriculture by numerous agricultural schools and colleges.

Among the most notable contributions of the colleges under the direction of foreigners in China, along scientific and technical lines, is that of the training being given by the Peking Union Medical College and the Medical College...
of Shantung Christian University in medical research, in administration of medical education, and in the practice of medicine. Shantung Christian University, Shanghai Baptist College, and Nanking University are doing splendid work in training for practice in general and applied chemistry; and Nanking University and Canton Christian College are making an outstanding contribution in training for leadership and extension work in scientific agriculture, especially crop improvement and the elimination of diseases affecting plants and silkworms. A great field still not adequately occupied is that of scientific animal husbandry and the protection of live stock against infectious diseases. This work ought to be taken up especially in Peking, Nanking, Hankow, and Tientsin, where there is a pressing demand for milk and dairy products by foreigners and foreign-educated Chinese.

There is a healthy rivalry between the College of Agriculture of the National Southeastern University and the Agricultural Department of Nanking University. The need for agricultural knowledge, and for constructive activity in scientific agriculture, is so great that the duplication in this section need not lead to waste. Also the rivalry, if generous and friendly on both sides, will do no harm, but will be good and stimulating in its effects. There ought to be the same sort of healthy rivalry between Peking (Yenching) University and the National Peking Technical and Agricultural Colleges, since the former, in addition to general college work and theological training, is giving some outstanding instruction in leather chemistry and technology, and in agriculture.

It will be seen from what has just gone before that already there is a decided trend towards such a specialization of effort on training
trend is in the right direction. for technical science and industrial technology as has been recommended.

Yet there is more duplication and a greater prevalence of small enrollments in many of these lines of work than there ought to be; and care should be taken in the future to guard against overproduction of graduates in certain specialized lines and especially against wasteful duplication of effort among the various institutions. An unfortunate example of this exists in Peking; for while the Nanking Higher Normal School has become a very strong teacher's college, incorporated within the National Southeastern University, where it logically belongs, the Peking Teachers College is entirely unaffiliated with the National Peking University. In 1922–1923 a movement was attempted to bring together several of the independent specialized government colleges and incorporate them with the university. Politics and inter-institutional and personal rivalries defeated this desirable end. The Teachers College has taken the name National Normal University; and is making the mistake of trying to develop advanced specialized courses along university lines, which are not at all adapted to the needs of prospective middle school teachers and administrators—the class of students which exclusively it should be aiming to train.

Failure to unite This attempt of its departments—to rival corresponding departments of the University, by the Teachers College, and also by other government colleges, is productive not of wasteful duplications alone. It results in a strong tendency on the part of the students toward too early specialization, particularly in science. Thus the students has led to serious ills. undertake advanced courses which they are not properly prepared to pursue and which have little relation to their future work as middle school teachers. On the other hand, they fail to get the sound fundamental training in the more elementary and unspecialized phases of the sciences, which is exactly what they most need. Contrasted with this Peking situation is
that in Paotingfu, where several independent institutions have been combined with Hopei University with a consequent reported improvement of them all in efficiency and enthusiasm.

Similar movements towards consolidation are desired, and are being considered, in other provincial centers; and such movements should be consummated wherever this is feasible. The Commission, which made a most admirable report on the Christian educational institutions,\(^1\) made some similar recommendations with regard to consolidation and avoidance of duplication among them; and this has resulted in changes that will make for greater coöperative efficiency.

III. SPECIAL NEED FOR TEACHER-TRAINING CURRICULUMS

When we come to the need for the training of science teachers for the middle and normal schools, and consider it in all its bearings, we perceive that this is the most urgent and the most widely needed of all the kinds of training that should be undertaken by the higher institutions.

All of the teachers colleges are of course specialized on the work of teacher training for the middle and normal schools; but the demand is so great that many of the colleges and universities ought also to take on this type of work as a special responsibility. What most of them are doing now is offering certain sources which prospective science teachers along with others may pursue if they so desire or must pursue in order to graduate. Few of them are offering a curriculum for middle school science teachers. Few are offering even single courses designed especially for the benefit of such teacher,

\(^1\)“Report on the Christian Educational Institutions,” 1923, the Commercial Press, Limited, Shanghai.
and taught by professors who can exemplify and illustrate good science teaching in their own practice. It is just here that an agency for co-operative study of the science teacher-training problem and for constructive action in solving the problem should be set up and begin immediately to function.¹

It is proposed that this co-operative agency shall be the Division of Teacher Training in the Department of Science Teaching of the Chinese National Association for the Advancement of Education. This department, with nine divisions, has been authorized by the Association for the purpose of active work towards devising feasible improvements, and getting them put into practice. The task of organizing it has already been commenced.

These, in my judgment, are the things that the colleges should do:

1. Determine what studies ought to be included in the education of every middle school teacher to give a broad basis for citizenship and some insight into the larger national problems. Such studies should be included as constants in every teacher-training curriculum.

2. Add to these the minimum of courses in psychology and education that every teacher should pursue, including also (for science teachers) the necessary special courses in the pedagogy of science.

3. Add the sequences of courses in physics, in chemistry, and in biology, from among which each science teacher is to choose his major and his minor sequence in science.

4. Include a list of elective courses of various sorts such as are likely to be especially broadening or particularly helpful to science teachers. Some of these should be specialized courses to meet specific

needs, while others should be cultural and informative courses for the purpose of rounding out the teacher's knowledge by giving him some ideas in fields outside the lines of his special preparation.

5. With this list, or program of studies, as a basis, make a curriculum for science teachers in tabulated form, and carefully check it up throughout, to make sure that it will work.

6. Publish this as a model or standard towards which any college may approximate to whatever extent its faculty think it desirable and find it feasible.

Each college for itself should then determine whether it can offer the entire curriculum or can only offer certain of the most needed courses. In either case, the next step is to select the teachers who are to give the courses determined on, taking care as far as possible to secure teachers who can use and exemplify good teaching methods in their own instruction. Have a fairly complete outline or syllabus made for each course. Then the final step is to see if the proper apparatus and equipment for each course is in stock; and if any things are wanting, acquire them.

IV. A CONTRIBUTION TO CURRICULUM REORGANIZATION

In order to assist in the cooperative work of curriculum making, I submit as a basis for discussion the accompanying curriculum in tabular form (pages 352 and 353). It represents my best and most careful thought on the problem as I see it. It may or may not be a close approximation to the best possible solution, but it will certainly supply something definite with which to start the discussion; and that will be a great help in getting started.

Notes. (1) Constants, 74 semester hours. Group options in science, 30; individual options, 12. Electives, 18 to 22. Minimum graduation requirement, 124 semester hours. (2) Certain shifts may be permitted in the studies of the second, third, and fourth years, in order to
<table>
<thead>
<tr>
<th>YEAR</th>
<th>SEMESTER</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native Language and Literature</td>
<td>Chinese</td>
<td>Ia</td>
<td>C (3)</td>
<td>Chinese</td>
<td>II a</td>
</tr>
<tr>
<td>Foreign Language and Literature</td>
<td>English</td>
<td>Ia</td>
<td>C (3)</td>
<td>English</td>
<td>II a</td>
</tr>
<tr>
<td>History, Social Science, and Philosophy</td>
<td>Modern World History</td>
<td>Ia</td>
<td>C (3)</td>
<td>Modern World History</td>
<td>II a</td>
</tr>
<tr>
<td>Psychology and Education</td>
<td>Personal and School Hygiene</td>
<td>Ia</td>
<td>C (1)</td>
<td>Public Health and Sanitation</td>
<td>Ib</td>
</tr>
<tr>
<td>Science Major and Minor Group Options</td>
<td>Major Science</td>
<td>Ia</td>
<td>O (3)</td>
<td>Major Science</td>
<td>II a</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Mixed Mathematics Ia or College Algebra</td>
<td>C (3)</td>
<td>Mixed Mathematics Ib or Trigonometry</td>
<td>C (3)</td>
<td></td>
</tr>
<tr>
<td>Free Electives</td>
<td>(3)</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Semester Hours</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

Suggested Curriculum
<table>
<thead>
<tr>
<th>III</th>
<th>IV</th>
<th>SEMESTER HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Chinese III b C (3)</td>
<td>Chinese III b C (3)</td>
<td></td>
</tr>
<tr>
<td>Economics III a or, Politico-economic Geography III a O (3)</td>
<td>Sociology III b or, Cultural-Industrial History III b O (3)</td>
<td>Modern Logic, and the Scientific Method IV a C (3)</td>
</tr>
<tr>
<td>Principles of Science Teaching III a C (3)</td>
<td>Methods of Teaching the Major Science III b O (3)</td>
<td>Methods of Teaching the Minor Science IV a O (3)</td>
</tr>
<tr>
<td>Major Science III a O (3) Minor Science III a O (3)</td>
<td>Major Science III b O (3) Minor Science III b O (3)</td>
<td>Minor Science IV a O (3) Minor Science IV b O (3)</td>
</tr>
<tr>
<td>(0 or 1) Minor Science</td>
<td>(0 or 1) Minor Science</td>
<td>(6 or 7) Minor Science</td>
</tr>
<tr>
<td>15 or 16 Major Science</td>
<td>15 or 16 Major Science</td>
<td>15 or 16 Major Science</td>
</tr>
</tbody>
</table>
facilitate the choice of free electives. (3) I means that the subject comes normally in the first semester of the first year, I means that it comes in the second semester of the first year, and so on. C means that the course is a constant and required of all students. O means that it is optional with another course, or that the sequence to which it belongs is optional with another sequence. The Arabic figures represent the number of semester-hours' credit assigned to the course: also the number of hours' attendance per week (two hours in the laboratory being counted equal to one hour in the classroom). (4) The major subject is the science on which the student chooses to specialize in teaching and the minor subject is a second science which he expects also to teach. Each student must take a sequence of three courses in his major science and a sequence of two courses in his minor science. (5) Each student must choose as electives two courses amounting to six semester hours from sciences other than his major and minor.

A few explanations concerning this curriculum may not be amiss.

a. First, it is easy to set down a program of studies which will satisfy the ambitions of all departments and the ideas of all individuals; but to get these studies down to such a number and such relative lengths that a student can actually get them into a workable schedule of sixteen hours a week is not so easy. Some drastic paring has to be done and some eliminations have to be made that are saddening to many persons of a conservative and sentimental temperament.

b. All will agree that every prospective teacher should study the Chinese language and literature in college. Whether eighteen semester hours is enough may be disputed. I leave that to the experts in Chinese, but would draw attention to the obvious fact that if more hours of Chinese or of anything else go into a block in any column of the checker board, then an equal number of hours of something
else _must go out_ of another block in the same column.

c. Most will agree that need of science teachers in China for the ability to read books in English on science and education is so great that the minimum of twelve semester hours of English is justified for this purpose alone. It should of course be so taught as to give the best facility in reading such books that can be gained in that time. Hence the reading practice in the second year should be largely on scientific and educational literature. Such books as Tyndall’s “Six Lectures on Light,” Slosson’s “Creative Chemistry,” Spencer’s “Education,” and James’s “Lectures to Teachers on Psychology” are excellent for this purpose on account both of their vigor and simplicity of style and their interesting and informative content.

d. Those who have studied education in America will perhaps think that the sequence in psychology and education is too limited. If so, I would suggest that the curriculum is for the training not of educational theorists but of practical teachers and community leaders in natural science. The sequence includes what to me seems to be the minimum that will meet their _practical needs_; and I believe the amount is sufficient.

e. Since knowledge and training in the content and method of the sciences they are to teach is the thing of first importance, thirty semester hours are assigned to the two sciences selected as major and minor. In addition it is required that each student pursue as an elective six hours in one or two sciences other than his major and minor, so that he shall have some knowledge of biology, of physics or chemistry or astronomy or meteorology, and of geology or mineralogy.

f. Students who select physics as a major should be advised to elect analytic geometry and calculus in addition to the required freshman mathematics.
g. The electives offered should include mathematics, 6; geology, 3 or 6; astronomy, 3; meteorology, 3; free-hand drawing, including rapid blackboard sketching, 3; mechanical drawing, 3; color work and design, 3; manual training, 3 or 6; physics shop course (repairing and making apparatus, glass blowing, etc.), 3; photography and lantern slide making, 1; biological technics (taxidermy, collecting, preserving and mounting, and identification of plants, insects, etc.), 3.

h. The maximum requirement is sixteen hours a week and the minimum is fifteen. **No student should be allowed to carry more than sixteen hours unless the case is an exceptional one and the student is known to be able to do it successfully.**

Since it is the common practice in China at present to require students to take from twenty-five to thirty-six hours a week, this proposition may seem to many to be a startling innovation. It is, however, an innovation that will have to be made if the colleges of China are going to make their students do the work of the curriculum instead of doing it for them. If the colleges are to give real college training and make their students **learn by doing**, they must provide their students **time** for study outside the classrooms, and then conduct their courses in such an exacting manner that the students have to **use** that time. When students are attending classes during five or six hours of every day they may learn only what they can soak up like a sponge; and that is not much.

i. In addition to the one hour a week in hygiene and public health, which is here prescribed for every freshman, there should be a requirement of a physical examination and health program for every student. This should be a general college regulation, and is outside the curriculum requirements.
With respect to the health program it may be said that the prospective teachers are very unlikely to cooperate in their schools in making health regulations and enforcing them on their students unless they learn the value of these personally through the benefits of physical examination and enforced health habits.

Colleges are advised to consult with the National Health Council, 5 Quinsan Gardens, Shanghai, and get their help and advice in setting up their new health regulations.

V. COURSES FOR TEACHERS IN SERVICE

Attention has been called repeatedly to the need of most of the present middle and normal school science teachers for help in improving their methods. These teachers ought to be encouraged in every way possible to attend regular or summer sessions in universities and colleges, and acquire the basic laboratory training in science and the pedagogical knowledge that they lack. They should be given leaves of absence and subsidies as may be necessary. Every province should send a few picked teachers each semester and each summer; and these when they return should be required to report to the other teachers on the best things that they have learned.

Ordinarily such a teacher will have only one term to spend—at least in any one year; hence he will need to concentrate closely on what he most needs.

First of importance is the course on the teaching of his major teaching subject. This should be based on a review of such content material as is judged to be most suitable for teaching in the middle schools. It should involve

1. A critical study of the choice of topics.
2. Intensive study of the high spots,—the most difficult portions—with exemplification and discussion as to the best ways of presenting them, and the experiments and demonstrations that should go with them
3. Critical consideration of the list of class demonstrations and laboratory experiments and their proper correlation with the subject-matter topics.

4. The easy demonstration experiments may be passed over lightly. Each one that involves difficulty, either in performing it or in presenting and teaching the idea that it is intended to convey, should be presented to the class by one of its members. The person assigned to present it should previously discuss it with the professor in charge, and rehearse it if necessary so as to do it in the best possible form. Then, if necessary, after the experiment has been made and the topic with which it goes has been taught just as it should be taught to a middle school class, the whole performance should be critically discussed.

5. Each member of the class should perform carefully, completely, and accurately in the laboratory every one of the accepted list of laboratory experiments, and should write up his notes on it just as he is expected to require his own middle school pupils to do. The professor in charge should examine and criticize his notes and cause him to revise them just as would be required of a middle school student.

Having thus gone through the exact experiences which his pupils must go through, the teacher will then know how to supervise and instruct his pupils, anticipate their difficulties, and give them just the help and stimulus that they need.

6. Instruction should be given the teachers on how and where to purchase apparatus, how to store, care for, and keep it in repair, how to make homemade apparatus, and how to find apparatus and practical applications in the local shops, in the home, or on the streets.

If the subject is biology, the class should be taught the collection, preserving, mounting, and identification of specimens for the school museum or materials for use of the students in their laboratory studies.

7. Each member of the class should also be required to make in the laboratory the more difficult
demonstration experiments and write out just such a notebook account of each one of them as that which he is expected to require of his students.

8. There should be a thorough discussion of the project method, and of library assignments.

Having gone thoroughly and conscientiously through such a course as this under a teacher who is a master of the art, any of the teachers now in the middle schools ought on his return to be able to earn a rating as a superior or excellent teacher. He will know just what the best procedure is and how to carry it out.

The second important need of these teachers is for more advanced study of college grade in their sciences, both classroom discussion and laboratory work — not lectures. Such courses the teachers should be allowed to select with faculty advice according to their knowledge, needs, and interests. These may be chosen from the regular college courses. Including the teaching course, the total work allowed should not be greater than sixteen credit hours, or in exceptional cases perhaps eighteen hours. If the situation be tactfully managed, no difficulty should arise from having experienced teachers and undergraduates working in the same classes. The undergraduates will benefit immensely from the presence and experiences of the veteran teachers, and the latter should suffer no inconvenience from the presence of the former. Both want the same kind of instruction, but if the two groups are large enough there is no objection to handling them in different sections.

VI. Training Science Teachers for Community Leadership

Those who are responsible for the training of science teachers ought to use every opportunity to impress upon them the obligation to be leaders in scientific matters in their respective communities. The science teacher ought occasionally to give popular lectures at community
Teachers of science should be the apostles and exponents of science in their communities. Centers on science, sanitation and health, on agricultural and industrial development, and on such other topics in his line as may contribute to the education of the people who are not ordinarily reached by the school.

He ought to be a leader of the elementary teachers and help them occasionally in the development of their instruction in nature study.

If his line is biology he ought to specialize on the collection and identification of some classes of the plant or animal forms of the locality, and interest the Boy Scouts or Girl Scouts of his school in his special line of nature study.

He ought to join with the other science teachers in forming a science teachers’ club; and such a club should be active in promoting health work, especially the extermination of flies and mosquitoes.

Finally, he ought always to be on the lookout among his students for those who show special interest, ability, and promise in science. He should help and encourage these to go on and get a scientific education, so as to become productive workers in the scientific field.

Such opportunities to render service as apostles of science outside their school duties ought to be impressed upon these teachers and prospective teachers by their professors in their contacts with them.

VII. CONCLUSION

The character and destiny of science teaching in China during the next ten or fifteen years is in the hands of the science teachers of the schools and the professors of science and education in the higher normal schools and colleges. They are training those who will do the scientific and technical work of the immediate future. More important still they are training the future science teachers who in the middle schools must lay the firm foundation for better and more thorough work in science by their students when these students enter college.
Hence the ultimate future of scientific development in China, as well as the immediate future is to be determined by her present science teachers. To all of these teachers of science in both the schools and the colleges I extend my best wishes for success in their great work. The many of them whom I have met have been very kind to me; and I am better for having known them. My most sincere wish as I am about to begin my homeward journey is that some of the things which I have tried to do while among them may be really and permanently helpful to them, and through them to the Chinese people.
VITA

GEORGE RANSOM TWISS: Born, Columbus, Ohio, 1863. Educated in Columbus Public Schools 1869-1881. Ohio State University 1881-1885, B.Sc. 1885. Graduate study in the natural sciences and in education at various times (1897-1914) at Harvard University, Western Reserve University, University of Chicago and Columbia University. Teacher of the natural sciences, Rayen High School, Youngstown, Ohio, 1885-1891; Central High School, Columbus, 1891-1894; Head of the Department of Science, Central High School, Cleveland, 1894-1908. High School Visitor, Ohio State University, 1908-1914. Professor of the Principles and Practice of Education at same university since 1914. State High School Inspector (half time) 1914-1921. Taught in summer sessions at Harvard University, Department of Geography, 1899; University of Missouri, Department of School Administration, 1916, 1917, 1918. U. S. War Department District Supervisor of Personnel Methods, Student Army Training Corps, Oct. 15 to Dec. 31, 1918. Educational Survey of Ohio State Industrial Schools, 1919. With U. S. Bureau of Education Staffs, educational surveys of Memphis, Tenn., 1919, Territory of Hawaii, Winchester, Mass., and Wilmington, Del., 1920. School building survey and program for the city of Niles, Ohio, 1921. Survey of science teaching and equipment in thirteen colleges for negroes in southern states, for the General Education Board, 1922. Survey and reports on which this volume is based, made for the Chinese National Association for the Advancement of Education June 30, 1922 to July 10, 1924.

PREVIOUS PUBLICATIONS


Ohio High School Standards (with F. C. Landsittel), State Department of Public Instruction, 1917 and later.


The School Housing Problem of Niles, Ohio, Board of Education, Niles, Ohio, 1921.