The Adolescent Concept of Intelligence and Gardner’s Theory of Multiple Intelligences

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Abstract
This study examined sixth- and eleventh-grade students’ definitions of intelligence as well as the relationship between their grades in school and their strengths in terms of Gardner’s eight multiple intelligences. The experimenter hypothesized that sixth grade students would agree with the dictionary definition of intelligence less than eleventh grade students and that the logical-mathematical and linguistic intelligences would be most important to a student’s success in school. A 39-question survey was given to 52 participants: 13 females and 16 males from the sixth grade at Booker T. Washington Junior High School in New York, NY; and 10 females and 13 males from the eleventh grade at Bronx School of Law and Finance in Bronx, NY. The results indicated that sixth grade students agreed with the dictionary definition of intelligence less than did eleventh grade students, and differences in scores for each of the eight multiple intelligences could be seen based on grades in different subjects although these differences were not statistically significant. These data suggest that both logical-mathematical and linguistic intelligences are important in students’ academic performance, but are not the only important intelligences needed for good performance in a given school subject.
The Adolescent Concept of Intelligence and Gardner’s Theory of Multiple Intelligences

What does intelligence mean? In many cases, a person’s concept of what it means to be intelligent is based on scores and grades: it is based on performance. With the pressure to perform mounting as adolescence progresses, it seems that this definition of intelligence could be more prominent than ever. Unfortunately, some adolescents’ motivation, skill set, or circumstances do not allow them to perform as desired in school. Does this mean these teens are not smart? Gardner’s Theory of Multiple Intelligences suggests it does not.

*Gardner’s Theory of Multiple Intelligences*

Howard Gardner (1993) states that his intelligences recognize multiple facets of cognition and attempt to acknowledge people’s different strengths and styles, creating a definition of intelligence that is broader and more applicable to the “plurality of intellect” (Gardner, 9). Initially, Gardner identified seven intelligences: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal. Gardner states that traditional schooling is not always appropriate for students’ particular distributions of intelligences. He says that his multiple intelligences are, “raw, biological potentials, which can be seen in pure form only in individuals who are, in the technical sense, freaks. In almost everybody else the intelligences work together….” (Gardner, 9).

M. Checkley (1997) summarized Gardner’s multiple intelligences and their implications for society. People who are linguistically intelligent, including speakers, writers, and lawyers, are described as easily being able to use language to express themselves and relate to others. Logical-mathematically endowed people are able to understand the main ideas behind causal systems and manipulate numbers. Visual-spatial intelligence is defined as the ability to create mental picture of space, an intelligence that is possessed by people such as artists, scientists, and
pilots. The bodily-kinesthetic intelligence is found in people for whom physical involvement in activities is very important, such as athletes, dancers, and actors. They incorporate their bodies into problem solving, create things, or perform in some way. Musically intelligent people constantly have music in their heads—they “think in music” (Checkley, 9) and can easily hear, recognize, remember, and manipulate patterns in that music. An excellent example of a person with astronomical musical intelligence is Mozart. People with high interpersonal intelligence, including teachers, politicians, and salespeople, are extremely skilled at understanding and relating to others. Intrapersonally intelligent people have an ability to understand themselves well and are often attractive to others because of this quality. They are well-aware of their strengths, weaknesses, and desires, as well as their reactions to certain situations. In later years, Gardner added an eighth intelligence: naturalist intelligence. This intelligence is exemplified in people such as hunters, gatherers, farmers, chefs, and botanists. Naturalistically intelligent people are sensitive to features of the natural world, can recognize patterns in nature, and can discriminate among living things.

Diane M. Coffman (1999) asserts that schools do not address peoples’ multiple intelligences, and are more focused on the linguistic and logical-mathematical intelligences than any others. She states that students who are not skilled in these areas might be categorized as slow learners even if they perform well in areas that are more suited to their intelligences. Checkley (1997) writes that Gardner believes students must be allowed to show their understanding in ways that complement their abilities rather than being tested in only one way.

*Student Concept of Intelligence*

If, as Gardner, Checkley and Coffman assert, many students’ understanding is not assessed in a way that complements their abilities, how could students be affected?
Carol I. Deiner and Carol S. Dweck (1978) wanted to determine how failure affects cognition and motivation in school-age children. They identified two types of children: helpless-oriented children and mastery-oriented children. After failure, helpless children attributed their performance to a lack of intelligence, and showed decreased performance and motivation. They even started using erratic strategies that were not at all helpful and were very negative after experiencing setbacks. In contrast, the mastery-oriented children were motivated to try and change their strategies after failing at a task. In fact, when mastery-oriented children were asked if they thought they failed, they said no. Deiner and Dweck’s study demonstrated that some students could be beaten down by failure, beginning a cycle that caused their performance to worsen after each failure.

Carol S. Dweck (1986) looked specifically at students’ motivational patterns. She defined adaptive motivational patterns as creating, maintaining, and reaching challenging, realistic, and valued goals. People possessing adaptive motivational patterns seek out challenges and are persistent. Maladaptive motivational patterns were defined as patterns that fail to create, maintain, and reach challenging and valued goals. In fact, maladaptive achievement goals are often unrealistic, which cause feelings of failure that perpetuate the maladaptive patterns. Dweck defined an appropriately challenging task as one that requires someone to use his abilities as well as allows him to improve upon them. Dweck saw that students who were focused on performance viewed setbacks as a reason to give up, while students who were focused on learning viewed setbacks as a reason to work harder. Because she could see that students reacted differently to academic setbacks, Dweck reasoned that drops in achievement could come from shrinking away from challenges, fear because of previous failure, or poor skills. Dweck asserted that the best way to create adaptive motivational patterns was a challenging, learning-oriented
environment that addresses motivation and urges students to continue to try after they fail. This study shows that in order to remain motivated, students must be appropriately challenged in a learning-focused, supportive environment.

B.D. Jones, C.N. Byrd, and D. Lusk (2009) researched how high school students think about intelligence. They found that as children move into the older grades, their concept of intelligence narrows. Younger students were more likely to incorporate work habits, social skills, athletic skills, and other nontraditional elements into their definition of intelligence than older students. Jones, Byrd, and Lusk found that this broader definition of intelligence tended to become less prominent around 10 to 12 years of age. Jones, Byrd, and Lusk asked participants to rate their perception of their own intelligence on a scale of one to seven and to report their grades, where an A was given a score of one and an F was given a score of five. Students were also asked open-ended questions about their definition of intelligence. Researchers found five major themes in students’ definitions of intelligence: “knowledge, skills and abilities”; “academic effort”; “achievement”; “decision making”; and “personal characteristics” (Jones et al., 3). Most students believed intelligence was malleable, and they tended to get better grades than students who believed intelligence was a fixed entity. Jones, Byrd, and Lusk found overall that high school students believed intelligence was a malleable property based in thought, effort, and ability, and that they thought academic effort was an especially important component of intelligence. This study showed that younger students may have a broader definition of intelligence than older students, and that many students believe intelligence to be a changeable trait.

D.B. Miele, B. Finn, and D.C. Molden (2011) wanted to see how Carol S. Dweck’s definitions of entity theorists (intelligence is fixed) versus incremental theorists (intelligence is...
malleable) corresponded to the ELER heuristic (easily-learned-easily-remembered). The experimenters hypothesized that participants holding entity theories of intelligence would see making an effort as a sign that they were not intelligent enough to learn the new information, in line with the ELER heuristic and that participants holding incremental beliefs about intelligence would not see an increase in task difficulty as a measure of their intelligence. Using Indonesian-English word pairs of varying difficulty in one experiment where the participants also guessed how well they had learned, and using lists of nouns with large or small fonts in the second experiment, the experimenters found interesting results. They determined that incremental theorists did not use the ELER heuristic, and that they thought high effort just meant they were working hard to improve their skills. Conversely, entity theorists saw high effort as a sign of reaching the upper limit of their memory and intellectual capacity. This experiment showed that people’s views of intelligence affect how they interpret their own learning. According to Dweck’s (1986) research on motivation, this interpretation of learning can also strongly affect motivation and performance on future tasks.

The present study sought to determine whether students’ academic performance and definition of intelligence were affected by their intelligences as defined by Gardner (1993). The study was conducted by doing a 39-question survey of sixth and eleventh grade students in New York. Based on Jones, Byrd, and Lusk (2009) it was hypothesized that because younger students have a broader definition of intelligence, sixth grade students would agree with the dictionary definition of intelligence less than eleventh grade students. Based on Coffman (1999), it was also hypothesized that logical-mathematical and linguistic intelligences would be most crucial to students’ academic performance.

Method
Participants

The 52 participants in this study were male and female students from the sixth grade at Booker T. Washington Junior High School (BTW) in New York, New York, and eleventh grade students from the Bronx School of Law and Finance (BSLF) in Bronx, New York.

The 29 sixth grade students had an average age of 11.5 years (range: 11-12 years). There were 13 girls and 16 boys. Their middle school was a public middle school for gifted children.

The 23 eleventh grade students had an average age of 17 years (range: 16-18 years). There were 10 females and 13 males. Their high school was a small public high school.

Materials

The present study was conducted using a survey that was created by the experimenter with help from Professor Susan Sacks (see Appendix). The first set of questions asked students to state their age and sex, definition and self-assessment of intelligence, grades in English, Math, Science, Social Studies, Foreign Language, Physical Education, Art, and Music, and participation in after-school activities. The second set of questions asked participants to read a list of statements and check the box next to any statements that applied to them. The statements were taken from Seven Kinds of Smart by Thomas Armstrong as found in Coffman (1999) and there were three statements representing each of Gardner’s eight intelligences.

Procedure

The experimenter visited Booker T. Washington Junior High School and the Bronx School of Law and Finance on Wednesday, April 13 2011. Surveys were distributed to students who were instructed to answer the questions, leaving blank any questions that made them uncomfortable. Surveys were then collected and analyzed in Microsoft Excel® and SPSS®.

Results
For data analysis purposes, numerical values were assigned to letter grades: A=4, B=3, C=2, D=1, F=0. The multiple intelligence questions were scored with 1 meaning the student checked the box and 0 meaning he did not. Each intelligence was represented by three questions, meaning that each student was given an average score out of three for each intelligence.

For questions on scales of one to five, five represented the “high” end of the scale, meaning “strongly agree”, or “I really enjoy it”, or “I do this a lot”.

*Sixth Grade: Booker T. Washington Junior High School*

**Grades**

Students in averaged 3.89 in English (SD = 0.31, SE = 0.058), 3.55 in Math (SD = 0.74, SE = 0.14), 3.76 in Science (SD = 0.58, SE = 0.11), 3.90 in Social Studies (SD = 0.31, SE = 0.058), 3.69 in Foreign Language (SD = 0.66, SE = 0.12), 4 in Physical Education (SD = 0, SE = 0), 4 in Art (SD = 0, SE = 0), and 4 in Music (SD = 0, SE = 0). The only two school subjects in which variety among grades was shown were Science and Math, so the other six subjects were not analyzed further.

**Intelligence Scores**

Booker T. Washington students scored an average of 1.86 in linguistic intelligence (SD = 0.83, SE = 0.15), an average of 2.24 in visual-spatial intelligence (SD = 0.69, SE = 0.13), an average of 2.24 in musical intelligence (SD = 0.79, SE = 0.15), an average of 1.72 in logical-mathematical intelligence (SD = 0.92, SE = 0.17), an average of 1.90 in interpersonal intelligence (SD = 0.86, SE = 0.16), an average of 2.31 in interpersonal intelligence (SD = 0.93, SE = 0.17), an average of 1.48 in naturalist intelligence (SD = 0.69, SE = 0.13), and an average of 1.83 in bodily-kinesthetic intelligence (SD = 0.89, SE = 0.17).

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1 Please note that BTW students took music and foreign language pass/fail. All students passed, and for data analysis purposes, a pass was scored as a 4.
Grades and Intelligence Scores

For math and science class data, BTW students were broken up into two groups based on grades to compare grades and intelligence scores.

In math class, students were divided into A students and B students (only two students got below a B and were discounted as there was a roughly even division between A/B students). As shown in Figure 1, the four intelligences with the largest mean difference between A/B students were, in descending order, interpersonal, musical, logical-mathematical, and visual-spatial.

In science class, most of the students received A’s, so the second group was comprised of “Below A” students. As seen in Figure 2, the four intelligences showing the largest mean differences between A and Below A science students were, in descending order, logical-mathematical, naturalist, interpersonal, and visual-spatial.

The Concept of Intelligence

Students at BTW agreed with the dictionary definition of intelligence an average of 3.68 out of five (SD = 0.90, SE = 0.17). On a scale of one to five rating their intelligence, the sixth graders thought they deserved an average score of 3.96 (SD = 0.96, SE = 0.17). Students rated their enjoyment of school an average of 3.72 out of five (SD = 0.88, SE = 0.16), and their participation in after school activities an average of 3.45 out of five (SD = 1.32, SE = 0.25). After-school activities covered a wide range, from dance to theater to music to sports to spending time with friends.

Statistical Analysis

To determine whether strengths in the multiple intelligences had a significant effect on math and science scores for BTW students, eight one-way ANOVA tests were done, each using
one of the eight intelligences as the factor and both math and science as the dependent variables. The results of these ANOVAs showed all \( p \) values to be greater than 0.05.

To determine whether a BTW student’s average grade score (scale of 0 to 4) had a significant effect on the extent to which he agreed with the dictionary definition of intelligence or his rating of his own intelligence, a one-way ANOVA was done using average grade score as the factor and using definition of intelligence and self-assessment of intelligence as the dependent variables. For average grade score x definition of intelligence, \( F(6, 21) = 2.260, p = 0.077 \). For average grade score x self-assessment of intelligence, \( F(6, 21) = 1.670, p = 0.178 \).

Eleventh Grade: Bronx School of Law and Finance

**Grades**

Bronx School of Law and Finance 11\(^{th}\) grade students averaged 2.26 in English (SD = 0.92, SE = 0.19), 2.78 in math (SD = 0.85, SE = 0.18), 1.76 in science (SD = 0.77, SE = 0.16), 2.33 in social studies (SD = 0.86, SE = 0.18), 2.35 in foreign language (SD = 1.18, SE = 0.25), and 2.48 in physical education (SD = 1.16, SE = 0.24). Only 11 of 23 students took art, and 2 of 23 took music, so those two classes did not receive further analysis.

**Intelligence Scores**

For the multiple intelligence questions, students had an average linguistic intelligence score of 1.35 (SD = 0.98, SE = 0.20), an average visual-spatial intelligence score of 2.04 (SD = 1.22, SE = 0.26), an average musical intelligence score of 2.35 (SD = 0.83, SE = 0.17), an average logical-mathematical intelligence score of 1.57 (SD = 1.12, SE = 0.23), an average interpersonal intelligence score of 1.61 (SD = 0.89, SE = 0.19), an average intrapersonal intelligence score of 2.43 (SD = 1.16, SE = 0.24), an average naturalist intelligence score of 1.35
 Adolescents have an average full scale intelligence score of 12 (SD = 0.57, SE = 0.12), and an average bodily-kinesthetic intelligence score of 1.65 (SD = 1.19, SE = 0.25).

**Grades and Intelligence Scores**

For analysis of grades and multiple intelligences, students were split into two groups based on grades for each class. The two groups were A/B and C/D unless noted otherwise.

In English class, A/B versus C/D students showed the four highest intelligence differences, in descending order, in musical, linguistic, naturalist, and logical-mathematical intelligences (see Figure 3).

In math class, A/B students and C/D students’ top four differences in preferred intelligence in visual-spatial, logical-mathematical, intrapersonal, and linguistic intelligences (listed in descending order, see Figure 4).

In science class, only two students received above a C, so students were divided into C students and D students, and the two students above a C were discounted. As seen in Figure 5, the four largest differences among C students and D students in science were, in descending order, in visual-spatial, bodily-kinesthetic, intrapersonal, and logical-mathematical intelligences.

As seen in Figure 6, the four greatest differences between A/B social studies students and C/D social studies students were in the following intelligences (in descending order): visual-spatial, linguistic, musical, and intrapersonal.

In foreign language class, some students received F’s, so the second group was C/D/F. As seen in Figure 7, when divided by grades in foreign language classes, the four intelligences where A/B and C/D/F students exhibited the greatest mean difference, in descending order, were visual-spatial, linguistic, intrapersonal, and logical-mathematical.
As in foreign language classes, some students also received F’s in physical education, so the grading groups in physical education classes were A/B, and C/D/F. As seen in Figure 8, the four categories in which there was the greatest difference between A/B students and C/D/F students were, in descending order, visual-spatial, linguistic, intrapersonal, and logical-mathematical.

*Concept of Intelligence*

Bronx School of Law and Finance students agreed with the dictionary definition of intelligence with a score of 4.04 out of five (SD = 0.88, SE = 0.18) and believed that their intelligence scored 4.18 out of five (SD = 0.59, SE = 0.12). Students rated their enjoyment of school an average of 3 out of five (SD = 1.04, SE = 0.22) and rated their participation in after school activities an average of 2.48 out of five (SD = 1.24, SE = 0.26). After school activities included sports, singing, going to the gym, and spending time with friends.

*Statistical Analyses*

To determine whether strengths in the various multiple intelligences had a significant effect on grades in English, Math, Science, Social Studies, Foreign Language, and Physical Education, eight one-way ANOVA tests were done. In each test, one of the intelligences was used as the factor while the six subjects being tested were used as the dependent variables (Table 2). For the most part, these ANOVAs had $p > 0.05$. Notably, in physical education x bodily-kinesthetic intelligence, $F(4, 18) = 3.439, p = 0.030$.

To determine whether a Bronx School of Law and Finance student’s average grade score (scale of 0 to 4) had a significant effect on the extent to which he agreed with the dictionary definition of intelligence or his rating of his own intelligence, a one-way ANOVA test was done.
For average grades x agreement with definition of intelligence, $F(13, 9) = 1.137, \ p = 0.434$. For average grades x rating of own intelligence, $F(13, 8) = 1.237, \ p = 0.393$.

**Discussion**

The purpose of this experiment was to determine whether students’ preferred intelligences as defined by Gardner had an effect on their grades and views on intelligence. In this experiment, Booker T. Washington students’ grades were much higher than students from the Bronx School of Law and Finance. This difference was most likely due to the fact that BTW is a school for gifted students, while the BSLF is not. Keeping that in mind, differences in grades between the sixth and eleventh graders were not analyzed. Additionally, the experimenter explored differences between intelligences only in the context of the subjects’ academic classes. Intelligence scores were not analyzed on their own.

*Sixth Grade: Booker T. Washington Junior High School*

**Grades and Intelligence**

The ANOVA tests done to compare grades with multiple intelligence scores did not produce statistically significant results because $p$ values for all the tests were greater than 0.05. However, the data demonstrate interesting trends (Figures 1-2).

The largest intelligence differences between A and B math students were in interpersonal, musical, logical-mathematical, and visual-spatial intelligences. A students’ higher intrapersonal intelligence score suggests that math class, at least in sixth grade, requires students to be able to relate to others, possibly in group work. The higher musical intelligence scores among B students suggest that students who have high musical intelligence, who are very creative people, may not thrive in the structure of the math class. It also suggests that students with high musical intelligence may allow the musical patterns that are in their heads to overpower their thoughts,
leaving little room for concentration on mathematical patterns. The higher logical-mathematical intelligence score among B math students suggests that students who are more skilled in logical-mathematical intelligence may be bored by their math class, and might thrive in a more challenging or differently-structured environment. The A students’ higher visual-spatial intelligence scores suggest that in order to succeed in math, sixth grade students need to be able to mentally manipulate images. Perhaps these students are faced with many imagery-oriented math problems or problems involving visualization of space.

Science students who scored A and Below A showed the greatest mean intelligence score differences in logical-mathematical, naturalist, interpersonal, and visual-spatial intelligences. Below A science students scored higher in the logical-mathematical category, suggesting that these students, who are very good at understanding the causal systems and numbers involved in science, may be bored in science class, causing them to put forth less effort and receive lower grades. In the naturalist intelligence category, Below A students’ higher scores suggest that as people who are very interested in the natural world, its patterns, and the creatures that live in it, students who have high naturalist intelligence may get lower science grades because learning about science in a classroom setting does not tap in to their naturalist talents and seems boring compared to more hands-on or fieldwork-based learning. A students’ higher scores in interpersonal intelligence suggest that, like in the math class, students in science classes need to use their interpersonal skills for group work in class. For visual-spatial intelligence, A students’ higher scores suggest that, like in mathematics, science students who have high visual-spatial intelligence may get better grades because they are able to envision the parts of the scientific problem they are working on, which suggests that this particular science class is probably very visually and spatially oriented.
**Concept of Intelligence**

The results of the ANOVA for average grade score and definitions of intelligence were not significant because the \( p \) values for both agreeing with the dictionary definition of intelligence and self-assessment of intelligence based on that definition were greater than 0.05. These data show that sixth graders’ grades do not have a significant effect on their definition of intelligence or their concept of their own intelligence.

**Eleventh Grade: Bronx School of Law and Finance**

**Grades and Intelligence**

For data analysis purposes, the four intelligences with the greatest mean score difference between A/B English students and C/D English students were examined (Figure 3). A/B students’ greater musical intelligence score may suggest a relationship between the skills required in English, or the themes discussed in English, and either the skills used to recognize and remember music or the components of music that are most appealing to musically intelligent people. A/B students’ higher linguistic intelligence scores suggest that their superior abilities to use language, not surprisingly, are quite useful in an English class. C/D students’ higher naturalist intelligence scores suggest that the topics discussed in English class may not have much to do with the natural world, and either do not require discriminating among living things and patterns in nature or are less interesting to people who are acutely interested in the natural world. A/B students’ higher logical-mathematical scores suggest that their ability to understand causal systems is helpful in understanding the grammatical and symbolic systems discussed in English classes.

The four intelligences with the greatest mean difference between A/B students and C/D students in math were visual-spatial, logical-mathematical, intrapersonal, and linguistic (Figure
4). The possible roles of these intelligences in math grades were analyzed. A/B students’ much greater visual-spatial intelligence scores suggest that the ability to visualize and manipulate images and spatial arrays is very helpful in solving math problems and understanding mathematical concepts. A/B students’ greater logical-mathematical intelligence scores show that students who had high ability to understand causal systems and numbers were successful in math. A/B students’ greater intrapersonal intelligence scores suggest their ability to understand many different facets of themselves may help them devise study strategies or recognize when they need help understanding a concept. A/B students’ higher linguistic intelligence scores suggest that their high ability to express themselves may allow them to properly seek help, and that their high ability in using language to relate to others may help them in group project or group study situations.

Visual-spatial, bodily-kinesthetic, intrapersonal, and logical-mathematical intelligences showed the greatest mean score difference between C science students and D science students, and were thus analyzed to see their possible role in students’ science grades (Figure 5). C students’ much greater visual-spatial intelligence scores suggest that mental representation of space and images is useful in thinking scientifically. C students’ much greater bodily-kinesthetic intelligence scores suggest that students are being asked to incorporate their bodies into their scientific learning, most likely in the form of active, hands-on experiments or activities. C students’ higher intrapersonal intelligence scores suggest that their knowledge of themselves may allow them to develop good study strategies and to know when to ask for help. C students’ higher logical-mathematical intelligence scores suggest that students’ ability to understand principles and causal systems allows them to grasp and utilize scientific concepts.
Based on social studies grades, A/B students and C/D students showed the greatest mean difference in their scores for the visual-spatial, linguistic, musical, and intrapersonal intelligences (Figure 6). A/B students’ higher visual-spatial intelligence scores suggest that being able to mentally manipulate images, such as maps and timelines, or to visualize things being described in a textbook, is helpful in a social studies class. A/B students’ higher linguistic intelligence scores suggest their ability to use language is important in success in social studies, most likely because they are required to write essays, do presentations, and understand other cultures through language. A/B students’ higher musical intelligence scores suggest that there may be some similarity between the patterns in music and patterns studied in social studies classes such as migration, alternatively, high musical intelligence may be correlated with success in social studies because students may be able to attach a musical pattern to a series of dates or names they need to remember for a social studies test. A/B students’ higher intrapersonal intelligence scores suggest that, again, their ability to understand themselves allows them to create useful study strategies and know when to ask for help.

A/B and C/D/F students in foreign language showed the most difference in their intelligence scores for visual-spatial intelligence, linguistic intelligence, intrapersonal, and logical-mathematical intelligence (Figure 7). A/B students’ much higher visual-spatial intelligence scores suggest that visualizing images, for example when trying to remember the translation of a word, is helpful in learning foreign languages. A/B students’ higher scores in linguistic intelligence suggest that their high ability to use language was also, not surprisingly, helpful in learning a foreign language. A/B students’ higher logical-mathematical intelligence scores suggest that understanding a causal system, in this case the grammatical and syntactical systems of a language, is important in foreign language learning. A/B students’ higher
intrapersonal intelligence shows that knowledge of self is useful in studying a foreign language, probably for creating study strategies, and knowing when to ask for help.

Based on the ANOVA results for physical education x bodily-kinesthetic intelligence, bodily-kinesthetic intelligence overall does have a significant effect on grade in physical education, which makes sense because physical education is a class that uses the body for learning.

A/B and C/D/F students in physical education showed the greatest intelligence differences in visual-spatial, linguistic, intrapersonal, and logical-mathematical intelligences (Figure 8). A/B students’ much higher visual-spatial intelligence scores suggest that students who have higher spatial abilities are better at spatial aspects of sports such as catching a ball, and that students with lower spatial abilities, even if not graded down for poor ball-catching abilities, may be discouraged and therefore not try as hard because of their poorer performance. A/B students’ higher linguistic intelligence scores suggest that their communication abilities, often necessary in team sports played in physical education classes, help them to participate in physical education classes. This information also suggests that students who are less linguistically able may shy away from expressing themselves to their classmates during a game in physical education class. A/B students’ higher intrapersonal intelligence scores suggest that their attractive qualities (due to their high self-understanding) may help them in physical education class, either by giving them confidence or by making their peers involve them more in the class’ activities. A/B students’ higher logical-mathematical intelligence scores suggest that their ability to understand principles and causal systems helps them to grasp the rules and requirements of activities in physical education class, or perhaps that their attraction to rules and systems makes the rules involved in physical education class more interesting and thus more motivating to them.
Concept of Intelligence

In the ANOVA conducted to determine whether a student’s grades had a significant effect on his definition of intelligence and in the ANOVA to determine whether a student’s grades had a significant effect on his rating of his own intelligence, the result was a $p$ value greater than 0.05, meaning that neither effect was significant.

Conclusions and Questions for Further Consideration

This experimenter hypothesized that, based on previous research, sixth graders would agree more with the dictionary definition of intelligence than eleventh graders would, and that logical-mathematical and linguistic intelligences would be the most important in students’ academic performances.

In accordance with this hypothesis, sixth grade students said they agreed with the dictionary definition of intelligence less than eleventh graders did (3.68 out of 5 and 4.04 out of 5, respectively), indicating their broader definition of intelligence. The difference between these two average ratings is quite small (0.26), which makes sense in the context of Jones, Byrd, and Lusk’s (2009) finding that by about age 10 to 12, children’s concept of intelligence begins to narrow. These data could also be skewed by the fact that the sixth graders were from a gifted school and the eleventh graders were not, which may have caused students to develop very different definitions of intelligence.

In terms of Gardner’s Multiple Intelligences, the fact that BTW students’ intelligences were only analyzed in two classes, math and science, makes the data set for interpreting importance of intelligence quite small. Due to this fact, for the purposes of analyzing the prevalence of a particular intelligence among the top four difference scores between high-grade and low-grade groups in school subjects, only BSLF data was analyzed. Linguistic intelligence
and logical-mathematical intelligence, which were hypothesized to be the intelligences most crucial to success in school, appeared in the “top four” in five of the six subjects analyzed at BSLF. Linguistic intelligence was not in the top four for science, and logical-mathematical intelligence was not in the top for four social studies. Two other intelligences, visual-spatial and intrapersonal (neither of which appeared in the top four for English class), also appeared in the top four in five of the six subjects analyzed at BSLF, suggesting that they are equally as important in students’ success as linguistic and logical-mathematical intelligences. These findings confirm the hypothesis that logical-mathematical and linguistic intelligences are important for success in school, but add that visual-spatial and intrapersonal intelligences are equally important.

While the “top four” intelligences in BTW class data are not very useful because only two classes were examined, the differences in intelligence scores between A and B students (or A and Below A students) in math and science classes at BTW are still very interesting. In both math and science, B (or Below A) students scored higher than A students for almost all intelligences. In math, the only two intelligences where A students scored higher than B students were linguistic and visual-spatial. In science, the only intelligence where A students scored higher than Below A students was visual-spatial. These data recall Dweck’s (1986) statement that students need to be given appropriately challenging work. As was mentioned earlier in this discussion, students in the lower-grade groups at BTW may not have scored lower in class because of low ability, but because of low interest or motivation, which could be caused by work that was not challenging enough. To explore this idea, more research needs to be done on student motivation as it relates to grades and multiple intelligence scores.
This study presents many data that suggest interesting ideas and conclusions about the many facets of adolescent intelligence. However, this research cannot yet be applied to the greater field of psychology. The sample used in this experiment was very small, which probably caused the statistical results to be insignificant, and was also from two very distinct populations (which did not overlap across sixth and eleventh grade subjects). The lack of diversity among subjects and similarity of group make-up may have skewed results or presented results that are not comparable. The lack of variability among grades in some classes made them difficult to analyze, which also may not have given a full picture of the spectrum of intelligences involved in various school subjects.

On another note, the contents of the survey could be adjusted to perhaps get more significant results if the study was done with more participants. Using the current study’s survey, there were not enough questions related to each of Gardner’s multiple intelligence traits, nor were there enough questions relating to students’ concepts and definitions of intelligence. These questions were consciously pared down for the purposes of this study so that students would be more inclined to fill out the survey, but this decision may have been detrimental to the significance of the results.

Additionally, Robert J. Sternberg (2004) has identified several concerns with Gardner’s theory that future researchers should try to address. Sternberg states that as of 2004, no published study had tested the theory in its entirety. Sternberg also mentions that Gardner’s support for his theory is not based on research designed for the theory, but on post-dated analysis of other studies. He also asks if the eight intelligences defined by Gardner are the only ones, and how the scientific community can ever be sure that all the intelligences have been defined. According to Sternberg, there needs to be a more systematic way to assess the intelligences (both
their existence and a person’s “level” of that intelligence) if the theory is to be supported, and programs using the theory need to be better evaluated.

Upon reviewing the shortcomings of this study and Sternberg’s critiques of Gardner’s theory, some obvious changes and questions for future research are brought up. Future research should use a large, diverse sample size with a more extensive questionnaire to assess students’ definition of intelligence, view of their own intelligence, strengths and weaknesses in terms of Gardner’s Multiple Intelligence Theory, and their motivation in school. Future research should also be sure to assess the eight existing intelligences systematically (looking for other intelligences is the topic of another study entirely) and attempt to conduct this assessment over a long period of time to show whether the trends found in this study are stable or a product of a particular set of participants.
References


Figure Captions

*Figure 1.* BTW students’ average math grades compared to their average scores in the eight intelligences.

*Figure 2.* BTW students’ average science grades compared to their average scores in the eight intelligences.

*Figure 3.* BSLF students’ average English grades compared to their average scores in the eight intelligences.

*Figure 4.* BSLF students’ average math grades compared to their average scores in the eight intelligences.

*Figure 5.* BSLF students’ average science grades compared to their average scores in the eight intelligences.

*Figure 6.* BSLF students’ average social studies grades compared to their average scores in the eight intelligences.

*Figure 7.* BSLF students’ average foreign language grades compared to their average scores in the eight intelligences.

*Figure 8.* BSLF students’ average physical education grades compared to their average scores in the eight intelligences.