

Gender Difference Variables Predicting Expertise in Lecture Note-taking

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ABSTRACT

GENDER DIFFERENCE VARIABLES PREDICTING EXPERTISE IN LECTURE

NOTE-TAKING

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Lecture note-taking is an important study strategy used by a majority of college students to record important information presented in class. Research suggests that there may be gender differences in note-taking and test taking. However, previous research on lecture note-taking has only examined gender differences, or used gender as an anecdotal variable, in post-hoc analyses. This is the first dissertation to investigate gender differences in lecture note-taking directly. More specifically, the primary purpose of this dissertation was to determine if gender differences in lecture note-taking exist, and if they do, to examine the cognitive and motivational variables that might explain them. A second purpose was to determine if there might be gender related differences in test performance. This research is an extension of research on lecture note-taking expertise (Peeverly, Ramaswamy, Brown, Sumowski, Alidoost, & Garner, 2007), in which a reanalysis of their data found that females wrote faster than males, had higher quality notes, higher semantic retrieval scores, and performed better on written recall of the lecture (Reddington et al., 2006).

A sample of 139 undergraduate students took notes from a prerecorded lecture, and were later allowed to review their notes before taking a test of written recall. The independent variables included transcription fluency, working memory, verbal ability,

conscientiousness, and goal orientation. The dependent variables were note quality and written recall. All procedures were group administered.

Results indicated that females recorded more information in notes and recall than males. Females also performed significantly better on measures of transcription fluency, working memory, verbal ability, and conscientiousness. Note quality was significantly predicted by verbal ability, gender, and the gender x verbal ability interaction, while written recall was significantly predicted by transcription fluency, mastery goal orientation, and the gender x conscientiousness interaction. Future research should continue to focus on examining potential gender differences associated with note-taking and test performance.

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Chapter 1

Introduction

Lecture note-taking is a strategy used by students to record important information presented in class. Among college students, most perceive note-taking to be an important educational activity (Van Meter, Yokoi, & Pressley, 1994), a vast majority take notes in their classes (Hartley & Marshall, 1974; Nye, Crooks, Powley, & Tripp, 1984; Palmatier & Bennett, 1974), and research has shown that recording and reviewing notes from classes is associated with good test performance (Bretzing & Kulhavy, 1981; Fisher & Harris, 1973; Kiewra, 1985; Kiewra, DuBois, Christian, McShane, Meyerhoffer & Roskelley, 1991; Kiewra & Fletcher, 1984; Peverly, Brobst, Graham & Shaw, 2003; Rickards & Friedman, 1978; Titsworth & Kiewra, 2004).

There is a great deal of research supporting the effectiveness of note-taking. Several studies have found that information recorded in notes is more likely to be remembered than information that was not recorded (Aiken, Thomas, & Shennum, 1975; Bretzing & Kulhavy, 1981; Einstein, Morris, & Smith, 1985; Keiwa & Fletcher, 1984). An analysis conducted by Kiewra (1985b) examined 56 studies comparing note-taking to listening during lectures, 33 of these studies showed that students who took notes had higher achievement than those that merely listened. Other studies conducted by Crawford (1925), Fisher and Harris (1973), Kiewra (1985b), Kiewra (1987), and Locke (1977) all found significant correlations between note-taking and academic achievement when students reviewed their notes. Furthermore, Peverly, Ramaswamy, Brown, Sumowski, Alidoost, and Garner (2007) found that the quality of notes were related to test performance, while Fisher and Harris (1973) found that college students who both

recorded and reviewed their lecture notes had greater free recall and multiple-choice performance than those who did not record notes and/or review their notes. Finally, Kiewra et al., (1991) found that those who took and reviewed their notes outperformed those who did not review. The latter group in turn was not significantly different than those who listened to a lecture only or to those who did not review their notes.

Analyses of the act of lecture note-taking suggest that it is a difficult and cognitively demanding skill (Peverly, 2006; Peverly, Ramaswamy, Brown, Sumowski, Alidoost, & Garner, 2007; Piolat, Olive & Kellogg, 2005). Note-takers must attend to the lecture, hold information presented in the lecture in working memory, select and or construct the information that is the most important to remember before the information is forgotten, transcribe the information quickly, again before it is forgotten, and maintain the continuity of what the instructor is saying.

Regardless of the importance of note-taking to academic success among college students, and the extent of the conjecture on the skills that are related to effective note-taking, there is very little research on the cognitive and other person variables associated with expertise in lecture note-taking. There are, however, some intriguing findings. Despite the *prima facie* importance of verbal working memory (VWM) to expertise in lecture note-taking, evidence in support of VWM is equivocal. Some have found a relationship (Kiewra & Benton, 1988; Kiewra, 1987; McIntyre 1992) and others have not (Cohn, Cohn and Bradley, 1995; Peverly, et al., 2007). In addition, across two studies, Peverly, et al. (2007) found that transcription speed (and not VWM, verbal fluency, spelling skill and the ability to identify main ideas) was the only skill to consistently predict quality of lecture notes. Finally, and most interestingly, there is some evidence to

suggest that females are better note-takers than their male counterparts (Kiewra, 1985b; Cohn et al., 1995; Cohn, Hult, & Engle, 1990; Nye 1978; Maddox & Hoole, 1975; Peeverly et al., 2007). Kiewra (1985b) found that females noted more critical test-related points and words than did male students; in addition they outscored males on exams that tested information contained in lecture. Cohn, et al. (1995) found that females took more complete notes and transcribed 5.1 more units than males (Cohn, et al., 1990; Nye 1978; Maddox & Hoole, 1975) and note-taking was more predictive of the principal performance measures in a course for females than for males (Eggert & Williams, 2002). Finally, in a reanalysis of the data from Peeverly et al. (2007), Reddington, Sumowski, Johnson, and Peeverly (2006) found that females wrote faster than males (i.e., had greater transcription speed), had higher quality notes, had higher semantic retrieval scores and performed better on the exams. However, when all of these variables were included in a regression equation to predict test performance, only quality of notes was a significant predictor, suggesting that the effects of gender on test performance may be mediated by notes quality (caution should be exercised in interpreting these results because of the very small number of males as compared to females).

The purpose of this dissertation was to explore more systematically if females are better lecture note-takers than males, and if they are, why they are more skilled since the note-taking literature has not explored variables associated with gender related differences in note-taking. Specifically, this dissertation will explore the contributions of cognitive variables thought to be associated with expertise in studying (transcription speed, working memory, and verbal ability), some of which may be related to gender (e.g., transcription speed). In addition, students' conscientiousness will be examined,

since this variable has been found to be related to academic success and to gender differences in student's academic performance. And finally, academic goal orientation will be explored. Although the relationship between gender and goal orientation has not typically been measured, research has occasionally found gender related differences in academic goal orientation (Elliot & Church, 1997). Also, since differences in academic goal orientation are related to differences in academic achievement and students' reported use of study strategies they may also be related to gender. Thus, this dissertation will attempt to determine if there are gender related differences in note-taking, and if there are differences, if these can be accounted for by gender related variation in transcription speed, working memory, verbal ability, conscientiousness, and goal orientation. In addition, this study will also attempt to determine if these variables are in some way related to test-taking.

Females were predicted to have significantly higher scores than males on measures of transcription fluency, conscientiousness, verbal ability, mastery goal orientation, note quality and written recall. Also, it was hypothesized that gender, transcription fluency, verbal ability, conscientiousness, working memory, mastery orientation and approach orientation would all have a significant, positive relationship to quality of notes. Avoidance orientation was predicted to have a significant negative relationship to note quality. Furthermore, in addition to notes, verbal ability, conscientiousness and goal orientation were predicted to have a significant, positive relationship to written recall.

Chapter 2

Review of the Literature

The purpose of this literature review is to review studies that have examined cognitive as well as motivational predictors of note-taking and academic performance, while noting gender differences where applicable.

Transcription Fluency

As previously noted, note-taking is a highly demanding cognitive skill making automatized processes essential in order to preserve higher level resources. One of the most important automatized skills in writing and note-taking is transcription fluency. As early as the first 3 years of schooling, children are expected to acquire the skills necessary to use handwriting as a means of completing their school work (Lazlo & Broderick, 1991). By the time a child reaches the fourth grade, and school assignments become even longer and more frequent (Cornhill & Case-Smith, 1996), most children find that they can handle these tasks if they can produce readable text with minimal effort. Additionally, for most children, handwriting becomes sufficiently automatic so that the formation of text does not interfere with their inventive thinking processes (Scardamalia, Bereiter, & Goleman, 1982).

Berninger (1999) conducted a cross-sectional study on the development of composition skills that included 300 primary grade students (grades first through third), 300 intermediate grade students (grades fourth through sixth) and 300 junior high students (grades seventh through ninth). Composition was operationalized as compositional fluency (number of words written within the given time limit) and compositional quality (ratings of overall quality based on content and organization).

Berninger found that transcription fluency, as measured by a handwriting task and spelling test, and working memory, were significant predictors of composition skill across all three grade levels. However, while the amount of variance accounted for by working memory was relatively stable throughout (primary through junior high), transcription speed had a curvilinear relationship with composition skill across the three time periods. The amount of variance accounted for by transcription speed surpassed that of working memory in the primary years although it contributed more to compositional fluency than to compositional quality. In the primary years, transcription speed accounted for 66% of the variance in compositional fluency, while working memory accounted for 4%. In terms of compositional quality during these years, transcription accounted for 25% and working memory accounted for 8%. In the intermediate years, transcription speed accounted for 41% of compositional fluency and 42% of compositional quality, while working memory accounted for 7% of compositional fluency and 8% of compositional quality. In the junior high years, transcription speed accounted for 16% of the variance in compositional fluency and 18% of compositional quality, while working memory accounted for 6% of the variance in compositional fluency and 5% of compositional quality. The decrease in the amount of variance accounted for by transcription fluency in the junior high grades may be due to an increase in older students planning and revising abilities (McCutchen, 1995). Other studies in this area have also found that transcription speed in elementary and middle school writers was related to both the quality and length of written compositions (Berninger, Whitaker, Feng, Swanson, & Abbott, 1996).

Transcription speed also appears to be important to adults. Connelly, Dockrell, and Barnett (2005) demonstrated that handwriting speed is related to overall performance on an essay exam. Their experiment included two different essay conditions, one which was “pressurised” and another which was “unpressurised”. The “pressurized” group was required to write an essay to a pre-seen question within a one hour time limit that they were told would count towards a final course exam. The “unpressurised” group was required to write a short essay to a pre-seen question within a one hour time limit which they were told was in preparation for an exam. The researchers designed the “pressurized” situation to mimic one in which students were faced with a real life test situation where success would be important and therefore handwriting speed would also be important. In such a case, it is believed that exam stress impairs cognitive activity (Kanfer & Ackerman, 1996) by occupying more cognitive space and therefore making fewer cognitive resources available to the higher processes needed to write, leading to poorer essay quality. Thus, a student who is a slower writer would most likely have less working memory resources available for higher processes, for example planning and editing.

Connelly, et al. (2005) measured writing fluency using a simple measure which required the participant to write out the letters of the alphabet, in order and in lower case, as quickly as they could within one minute (Berninger, Mizokawa, and Bragg, 1991). The essays were scored using two measures of quality (conformance with a rubric (Connelly, Dockrell, & Barnett, 2005) and a rating by a tutor) and a measure of quantity (number of words written). Results showed that there was a positive significant correlation between the quality of the essay and the writing fluency task for the

“pressurized” group but not for the “unpressurized” group. In this case, the need for automatized processes is even greater when one is under cognitive pressure or stress, which is usually the case when one is required to record lecture notes. These data indicate that transcription fluency matters most when students are under a significant degree of stress such as a test or a faced paced lecture.

Connelly, Campbell, MacLean, and Barnes (2006) further demonstrated the importance of transcription fluency in adults. Participants included 21 dyslexic adults, matched to both a chronological-age control group and a spelling-skill control group. The spelling skill control group was made up of individuals whose spelling abilities were equivalent to that of the dyslexic group; this included 19 participants who ranged in age from 11 to 31. The chronological age matched group was made up of 20 adults, who were matched by age to the dyslexic group. All participants completed a writing task which consisted of writing an essay to a written prompt within a 30 minute time limit. The written prompt was chosen from topics included in the GRE Analytical Writing Measure (Educational Testing Service, 2004). Other measures included the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999), a handwriting fluency task (Berninger et al., 1991), working memory tasks, and the written expression subscale from the Wechsler Objective Language Dimensions (WOLD; Rust 1996). The Test of Word Reading Efficiency requires participants to read single words presented on a card as quickly as they can within 45 seconds followed by the same procedure using nonwords. The handwriting fluency task, as in demonstrated in Connelly, et al. (2005), requires participants to write out the letters of the alphabet as quickly as they can within one minute. The working memory task consisted of three memory span tasks, which included

forward span, backward span and listening span. The forward span task requires one to listen to a series of numbers orally presented to them and then to repeat back those numbers in the same order in which they were heard. The backward span task also requires participants to listen to a series of numbers orally; however they are required to recall the numbers in the opposite order than they were heard. The listening span task is an adaptation from Daneman and Carpenter (1980), which requires the participant to listen to a set of sentences, decide whether the sentences are true or false, and then recall the last word of each of the sentences. Visuo-spatial memory was assessed using the Tests of Memory and Learning (Reynolds & Bigler, 1994). Finally, the Wechsler Objective Language Dimensions was administered to examine text generation, such as spelling, grammar, punctuation, and vocabulary.

Results showed that the dyslexic participants performed significantly more poorly on the listening span and nonword reading tasks, and generated more spelling errors in their essays, than the comparison groups. Although it was predicted that dyslexic participants would perform more poorly on spelling than their age-matched peers, the finding that they had a higher number of spelling errors than their spelling-skills match peers was unexpected. In addition, dyslexic students also wrote shorter essays compared to the control groups as measured by the word count. Because transcription relies on handwriting fluency and spelling, dyslexic students were more disadvantaged than their chronological-age matched peers due to their spelling difficulties. The average speed of transcription fluency in these individuals is equivalent to that produced by children approaching 12 years of age in the UK (Connelly & Hurst, 2001), while the chronological-age matched group's average speed is equal to that of UK adults (Connelly

et al., 2005). There were no differences between the groups on reading real words; however dyslexic individuals had more difficulty reading nonwords due to phonological processing deficits. No differences were found between groups on the visuo-spatial memory task; however dyslexic participants had shorter forward spans than the age-match group and shorter listening spans than both control groups. This may demonstrate difficulties in working memory in dyslexic participants.

Overall it was found that the quality of essay writing in students with dyslexia was poorer than chronological-age matched controls due to differences in spelling accuracy and handwriting fluency. Dyslexic students wrote shorter essays and had more spelling errors than control groups. In addition, adults who were in “pressurized” situations showed a significant positive correlation between the quality of their essays and a writing fluency task. In summary, it appears that lower level transcription skills, such as spelling and handwriting fluency continue to be essential components of essay writing in adults.

Peeverly, et al. (2007) extended these findings and demonstrated that transcription fluency is a strong predictor of quality of lecture notes. Specifically, this experiment examined the relationship between quality of notes and verbal working memory, transcription fluency, the ability to identify main ideas, spelling, writing fluency, digit symbol copy, phonemic and semantic retrieval. The relationship between test performance and the aforementioned variables was also investigated. However, using Berninger’s (1991) alphabet task and the Woodcock-Johnson III - Tests of Achievement (2001) Writing Fluency subtest, it was found that transcription fluency was the only significant predictor of notes quality for college students and notes quality was the only

significant predictor of test performance. In a reanalysis of Peverly et al.'s (2007) data, females wrote faster than males on the alphabet task (Reddington et al., 2006). Females superior transcription speed in this experiment is also consistent with previous research demonstrating a performance advantage for females in handwriting speed (Cohen, 1997), and on the Coding subtest of the Wechsler Intelligence Scales (Lyle & Johnson, 1974; Lynn, Fergusson, & Horwood 2005; Slate 1998) which requires one to copy symbols into blank boxes which correspond to symbol-number pairs displayed above. Females also have performed better than males on tasks of speeded fine motor dexterity, such as the Grooved and Purdue Pegboard (Agnew, Bolla-Wilson, Kawas, & Bleeker 1998; Bornstein, 1985; Ruff & Parker, 1993; Schmidt, Oliveira, Rocha & Abreu-Villaca, 2000; Strauss, Sherman & Spreen, 2006) which both require speeded placement of small objects into the appropriate places on a given board.

Transcription fluency is therefore expected to be significantly and positively related to note quality in the current study. Also, females are expected to have significantly faster transcription speed than males. Transcription fluency is not expected to be directly related to test performance, as a relationship between these two variables has not previously been found.

Working Memory

Working memory is the ability to temporarily hold and manipulate information during cognitive tasks, such as learning and reasoning (Baddeley, 2000). Individual differences in working memory have been found to be positively and significantly related to a variety of academic tasks in both comprehension (Daneman & Merkle, 1996) and

writing (Kellogg, 1996; Levy & Ransdell, 2002; Olive, 2004) both of which are related to note-taking.

One of the reasons why working memory capacity is related to skill in academic tasks is because individual differences in capacity are hypothesized to play a role in how quickly and efficiently skills can be executed (Baddeley, 2001; Just & Carpenter, 1992; Swanson & Siegel, 2001). In the context of lecture notes, for example, those with a high working memory capacity should be able to store more information for a greater length of time, therefore allowing for a more precise and lengthy transcription of lecture notes. In addition, since it is necessary for notes to be recorded at the rate of the lecturer, the writer must store the words in working memory and transcribe them, while new information is being introduced. Furthermore, the note-taker is required to make decisions about what information is pertinent enough to write down, all of which has to be done quickly to avoid the spatial and temporal limitations of working memory.

Research on the relationship between working memory and note-taking has produced mixed results. While Cohn et al. (1995) and Peverly et al. (2007) found no relationship, Kiewra et al. (1988) found a positive relationship between these two variables. Participants in Cohn et al. (1995) were exposed to three of Turner and Engle's (1989) working memory measures – operation-word, sentence-word, and word span. The operation-word task, for example, requires a person to verify whether the solution presented to a mathematical problem is correct, while at the same time memorizing the word associated with each problem. At the end of the set, the participants have to report all of the words in correct serial order.

Peeverly et al. (2007) used Daneman and Carpenter's (1980) listening span test. This task requires participants to listen to groups of sentences that range from sets of two to six sentences. Participants have to determine whether the sentences they hear make sense or not by circling "yes" or "no" after each sentence. After each set of sentences is finished and participants hear a beep, they are required to recall and write down the last word of all of the sentences in the set. Daneman and Carpenter found that the listening span task and its variants, such as the reading span task, are correlated with a variety of verbal and academic skills.

Peeverly et al. (2007) noted that the discrepancies in the research may be due to the differing measures used to assess working memory across studies. For example, Kiewra et al. (1988) utilized a task that required participants to organize words into meaningful sentences or organize sentences into meaningful paragraphs; however this information was still visible to them during the task and may not have placed as much of a strain on working memory resources as a task that require subjects to remember information that is no longer in sight.

Previous studies have been unable to find gender differences on working memory tasks. In a study of gender differences in brain activation for language (Shaywitz, Shaywitz, Pugh, Constable, Skudlarski, Fullbright, Bronan, Fletcher, Shankweiler, Katz, & Gores, 1995) there were no differences between genders on the working memory tasks, however there was a significant difference in the part of the brain activated during these tasks. In addition Speck, Ernst, Braun, Koch, Miller, and Chang (2000) found robust gender differences in the patterns of brain activation during performance on working memory tasks. This finding is similar to Shaywitz et al. (1995) in that males and females

appear to be using different strategies when approaching the same task. However, research has not yet been able to explain these differences.

Even though research has been equivocal regarding the relationship of working memory to note-taking, logically speaking working memory capacity should be related to the quantity and quality of notes, given the significant relationships found between working memory and other academic skills such as reading and writing. Thus, working memory is expected to be positively and significantly related to note quality in the current study. However, there is not enough prior research to predict whether or not there will be a significant gender difference in working memory. In addition, working memory has not been shown to have a relationship with test performance, therefore it is not expected that these two variables will be related in the current study.

Verbal Ability

Gender differences in verbal ability have long been a topic of debate, dating back to 1974 with the publication of *The Psychology of Sex Differences* (Maccoby & Jacklin). On average, evidence has supported the notion that females have better verbal abilities than males (Halpern, 2000). However, it is important to note that the concept of verbal abilities is made up of several components related to the concept of language. This domain includes such skills as word fluency, grammar, spelling, reading, writing, vocabulary, and comprehension. Therefore gender differences may vary on these different components in terms of the size and direction of the difference. This is likely the reason for most of the discrepancies in the literature surrounding gender differences in verbal ability, as many of the research studies have measured different skills.

However, when gender differences are found on these measures, they are generally in favor of females (Halpern, 2000).

Martin and Hoover (1987) investigated the relationship between gender and achievement and analyzed the change in this relationship over time. They used a sample of males and females who were tested on the Iowa Tests of Basic Skills [ITBS] (Hieronymus, Lindquist, & Hoover, 1978) from Grades 3 to 8. The ITBS is an achievement battery that includes the following subtests: Vocabulary, Reading Comprehension, Spelling, Capitalization, Punctuation, Language Usage, Visual Materials, Reference Materials, Mathematics Concepts, Mathematics Problem Solving, and Mathematics Computation. Means and standard deviations for each test score were calculated for males and females. The means with the largest differences occurred in the areas in which females outscored males. Generally, these differences were found on the language tests, as females scored consistently better on the Spelling, Capitalization, Punctuation, and Language Usage subtests. Additionally, these differences tended to increase across grades. The Reference Materials and Mathematics Computation subtests also showed a small consistent advantage for females. Females also had higher means on the Reading Comprehension test, with the greatest difference occurring in Grade 3. However the other major measure of verbal ability, Vocabulary, was highest for females in Grades 3 and 4 while in the later grades males had a higher mean. In Grade 8, females tended to have the highest score on Language tests, with two-thirds of the highest scoring students being female. Overall, females performed better on Spelling, Capitalization, Punctuation, Language Usage, Reading Comprehension, Reference Materials and Mathematics Computation.

Females also appear to have an advantage over males in their writing abilities. Writing is a skillful and complex activity; one must have correct word usage and the ability to organize ideas as well as to construct grammatical sentences. Not only is writing important in the earlier years of education, but it is even more essential in high school, college, and beyond. Data collected by the National Assessment of Educational Progress (NAEP) showed that females' proficiency in writing surpassed that of males in grades 4, 8, and 11 in the years 1984, 1988, and 1990. More recently, in 2002, females performed better than boys at every grade level on a writing assessment. The gaps between females and males scores were 17 points in Grade 4, 21 points in Grade 8, and 24 points in Grade 12 (NEAP, 2002).

Hayes and Waller (1994) examined gender differences in overall reading ability and its underlying basic processes in adults. The researchers were specifically concerned with the speed and accuracy needed to read single words and how that component of reading might contribute to the female advantage often seen on verbal tasks. Participants included 504 adult students, 235 males and 163 females, from five campuses of a community college. The male participants had better education levels ($M=10.9$) than the female participants ($M=10.2$). Standardized tests included the Nelson Denny (Brown, Bennett, & Hanna, 1981), which was chosen to test vocabulary knowledge, comprehension, and reading speed, the Hayes – Gates – McGinite tests A & B which was used to assess reading speed, accuracy of reading comprehension, and word knowledge, the Cattell Culture Fair test (Cattell, 1973), to measure non-verbal intelligence levels, and the Test of Basic Reading Processes to test the processes thought to underlie reading single words.

The whole battery was administered in one 6 hour long session with frequent breaks. Overall, even though the females were less educated than the male participants, females made more correct responses on the Nelson Denny and Vocabulary tests. The mean Nelson Denny score for females was at the 64th percentile while the males' score was at the 50th percentile. There was no difference between the nonverbal IQ scores of males and females. In general, females were faster and were more accurate at basic processing tasks that involved words or knowledge of words. On tests that required precision and attention to detail the women were more accurate, but not faster. Females were also faster on tasks requiring the identification of letters. Therefore it was concluded that females have faster and more accurate word knowledge and faster letter identification and that this may, in fact, give them the advantage often found in the assessment of verbal skills. Additionally, males may be able to compensate for this disadvantage through the use of higher order processing if tasks require it; however if they are speeded, males may again be at a slight disadvantage. In general, this study suggests that one possible reason for the female advantage on verbal tasks may be females' better orthographic and lexical knowledge.

In summary, it is apparent that gender differences on verbal tasks exist, however the size and the reliability of these differences depends on which verbal tasks are being assessed, as some show no differences and others large differences. It is therefore predicted that verbal ability will be positively related to note quality and that females will perform significantly better than males. Given the research mentioned, it is predicted that verbal ability will be related to test performance.

Conscientiousness

Personality factors have long been thought to be related to academic success in addition to cognitive abilities. In particular, individuals who are very conscientious tend to be very meticulous, careful, thorough, and have a need for achievement (Costa & McCrae, 1992) Therefore, it seems likely that individuals high in conscientiousness would have excellent study skills, which would include taking good lecture notes.

Prior studies have used a variety of different personality measures to predict academic success; however these measures tended to assess different traits, which has made drawing conclusions difficult. More recently, however, personality psychologists have grouped these measures into five higher-order factors which include: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. The NEO-PI-R measures these 5 domains of personality and assesses 30 more specific traits, with 6 traits structured under each of the 5 domains. This measure is structured as an item response scale ranging from 1 (strongly agree) to 5 (strongly disagree). These five factors of the NEO-PI-R, also known as the “big five” were used by Lievens, Coetsier, Fruyt, and De Maeseneer (2002) to investigate which personality traits are typical of medical students and to predict students’ performance in their pre-clinical years. Medical students, as well as students in seven other academic majors, completed the NEO-PI-R (Costa & McCrae, 1992) and final scores, the average of all courses at the end of the year, were obtained. Lievens et al. hypothesized that the factor of conscientiousness, as well as related traits (competence, order, dutifulness, achievement, self-discipline and deliberation) would be correlated with academic performance. Results showed a significant main effect of academic major across all Five Factor Model domains. In order

to determine that the main effect was not due to gender, a MANOVA was conducted with gender as a covariate and the domains as the dependent variables. Gender, as expected, was a significant covariate, however when the variation due to gender was removed, academic major still had a significant effect. Medical students were found to be high on the Extraversion and Agreeableness scales and average on the Conscientiousness, Open to Experience, and Neuroticism scales. Furthermore, conscientiousness significantly predicted the final scores in each of the preclinical years. In addition, there were significant correlations between the final scores in all three years and the “achievement” and “self-discipline” traits. “Competence” and “deliberation” correlated with final scores in years 1 and 3, while “order” and “dutifulness” correlated with final scores in year 1. Finally, Leivens et al. conducted a logistic regression to determine if personality differences existed between successful and unsuccessful medical students. Conscientiousness was the only Five Factor Model dimension that had a significant regression weight. Conscientiousness scores were higher for successful than for unsuccessful medical students. Successful medical students also rated themselves significantly higher on three of the conscientiousness factors, namely “dutifulness”, “achievement striving” and “self-discipline”. Overall, students who scored high on conscientiousness were more likely to perform better academically in their 3 preclinical years. Furthermore, traits such as “self-discipline” and “achievement striving” better predicted performance than more inhibitory and regulatory traits such as “order”, “deliberation” and “dutifulness”.

Vialle, Heaven, and Ciarrochi (2005) examined gender differences on various characteristics pertaining to adolescent emotional well-being and academic outcomes in

high school students. One of the factors chosen was conscientiousness, as individuals described as having a high degree of this characteristic have also been described as being “persistent” and “well-organized” (Costa & McCrae, 1992). Also, Vialle et al. (2005) found this factor to be predictive of both positive school attitude and a higher self-rating on academic performance. In addition, low amounts of conscientiousness have been found to be related to more anti-social as well as high risk-taking behaviors (Heaven, 1996; Mak, Heaven & Rummery, 2003). In Vialle et. al. (2005) conscientiousness was measured using a 16-item instrument with a 5-point likert scale, designed by Mak and colleagues (2003). Sample statements include “I like to do things perfectly” and “I pay attention in school”. The alpha coefficient was .85. Participants were also given the Children’s Hope Scale (Lopez, Ciarelli, Coffman, Stone & Wyatt, 2000), Rosenberg’s (1979) self-esteem measure, the Parental Authority Questionnaire (Buri, 1991) and a set of items designed to measure “attitudes towards education” developed by Furnham and Gunter (1989). Participants completed the questionnaires individually and basic skill measures and school grades were obtained separately from the school. Results found that females scored significantly higher than males on conscientiousness, hope, mother’s authoritative parenting and attitudes towards schooling. However, only 16 % of the variance was explained by these variables, with conscientiousness accounting for 2.8%. Males, on the other hand, scored significantly higher on toughmindedness as well as negative affect. Therefore, conscientiousness, which has been associated with a desire for achievement, appears to favor females (Costa & McCrae, 1992), while toughmindedness, which has been associated with poorer academic performance and motivational functioning, tend to favor males (Heaven et al., in press).

Conscientiousness will be measured in the current study using the NEO-PI-R. It is predicted that females will score higher on the conscientiousness subscale than male participants and that conscientiousness will be positively and significantly related to quality of lecture notes. Conscientiousness is also hypothesized to be directly related to test performance.

Goal Orientation

Research on achievement goals originated from the work of Dweck (1986), Nicholls (1984), and others (Ames, 1984; Maehr, 1984). According to this theory, achievement goals are defined as “the purpose of the task engagement, and the specific type of goal adopted is posited to create a framework for how individuals interpret and experience achievement settings” (Elliot, McGregor, & Gable, 1999). Although the early theorists differed slightly on how they defined the different types of goals, because the frameworks were relatively similar, a consensus formed on the dichotomy of performance and mastery. Performance goals focus on one’s competence relative to others while mastery goals are more concerned with the development of one’s competence or actual mastery of the task regardless of the accomplishment of others. Another historical distinction in the literature on motivation is the theory of approach and avoidance motivation, which are now explained in terms of valence (Elliot and Thrash, 2001; Herzberg, 1966; Lewin, 1935). Approach motivation is directed by either a positive or desirable event, whereas avoidance motivation is directed by either a negative or undesirable event. Using the task of studying as an example, those with approach motivation are more likely to study in order to learn the material and receive a high

grade. Those with avoidance motivation, on the other hand, are more likely to study to prevent them from receiving a bad grade.

Elliot combined past theory and research to propose a revised achievement goal framework which incorporates both performance-mastery and approach-avoidance concepts. Elliot's conceptualization consists of four distinct orientations and is known as the 2 x 2 achievement goal framework. The four orientations include performance-approach goals, performance-avoidance goals, mastery-approach goals, and mastery-avoidance goals. A performance-approach goal is focused on attaining normative competence while a performance-avoidance goal focuses on avoiding normative incompetence (Elliot, 1999). The mastery-approach goal is focused on developing one's competence or mastery of a task while approaching success, the mastery-avoidance goal is also focused on one's competence or mastery of a task; however they also want to avoid failure. Therefore, both the mastery-approach and performance-approach goals are considered approach orientations because they both concentrate on positive outcomes; they differ however on how competence is defined. Mastery-avoidance and performance-avoidance goals, on the other hand, are clearly considered to be avoidance orientations as they both concentrate on avoiding negative outcomes. They both differ from approach goals in how competence is valenced. However, the two types of mastery goals (mastery-approach and mastery-avoidance) are considered unitary by other researchers and therefore are combined into one single mastery goal orientation, replacing the 2 x 2 framework with a trichotomy.

Elliot, McGregor, and Gable (1999) examined how achievement goals are used as predictors of self-reported cognitive/metacognitive and motivational study strategies.

They also explored how these study strategies act as mediators between achievement goals and performance on an exam. Undergraduate students enrolled in an introductory psychology class participated in the study for extra credit. Students completed an exam specific achievement goal questionnaire two weeks prior to their midterm exam. The achievement goal questionnaire, based on the trichotomy framework, was devised by Elliot and Church (1997) and included six items for each of the three achievement goals. Items were answered using a likert scale, which ranged from 1(not true at all) to 7 (very true of me). A week before the exam the students were given a questionnaire regarding their study approaches and were told to complete the questionnaire after they finished preparing for the upcoming exam. Items on the questionnaire were devised to determine whether students utilized deep processing, surface processing, or disorganized study strategies. The test consisted of items taken from existing measures (Entwistle, 1988; Nolen, 1988; Pintrich & Schrauben, 1992; Weinstein, Schulte, & Palmer, 1987), and items constructed by the authors. Five items were used for each of the three areas and were also based on the same likert scale as the achievement goal questionnaire. Students were given an unlimited amount of time to finish their exams, which were made up of multiple choice items, short answers, and essays. Exam scores were obtained from the professor. Students' GPAs were obtained from the registrar.

The authors used a regression model composed of the three goal orientations and GPA to test the three goals as predictors of exam performance and study strategies, while controlling for GPA. They also utilized a step-wise regression to test each study strategy as a predictor of exam performance, alone and then controlling for GPA. The main effect of gender was also tested and retained when significant. The results indicated that

performance-approach goals were positively related to exam performance, performance-avoidance goals were negatively related to exam performance, and mastery goals were not related. GPA was also a significant predictor of exam performance. In terms of study strategies, deep processing was found to have a significant positive relationship with mastery goals and a significant negative relationship to performance-avoidance goals. Surface processing and disorganization were both found to have significant positive relationships with performance-avoidance goals. GPA was found to be a significant negative predictor of disorganization. In terms of predictors of exam performance, deep processing was a significant positive predictor, while disorganization was a significant negative predictor. Gender had a significant positive relationship to disorganization and a significant negative relationship to performance approach goals. However, the study did not state how gender was coded; therefore it is unknown if there were gender differences between males and females on these constructs.

In summary, performance-approach goals were positively related to exam performance while performance-avoidance goals were negatively related. Mastery goals were unrelated to exam performance; however they were positively related to deep processing. Performance-approach goals were not related to any study strategy, while performance-avoidance goals were positively related to surface processing and disorganization.

A second study was performed in hopes of replicating and extending these findings. The only difference in the method of study 2 was that SAT scores were used in lieu of GPAs and students were asked their general-class achievement goals instead of exam-specific achievement goals. They also investigated the concepts of persistence and

effort as study strategies in addition to the three discussed previously. It was found that performance-approach goals continued to be positively related to exam performance, while performance-avoidance goals were again negatively related to exam performance. SATs scores were also positive predictors of exam performance. Mastery goals were positively related to deep processing, while performance-avoidance goals were negatively related. Gender was a significant predictor in this model, as males were more likely to engage in deep processing than females. Performance-approach and performance-avoidance goals were positively related to surface processing. Performance-avoidance goals were also positively related to disorganization. In terms of the relationships between the two study strategies, persistence and effort, both mastery goals and performance-approach goals were significant positive predictors. Finally, when examining exam performance, deep processing, persistence, and effort were all significant positive predictors, while disorganization was a significant negative predictor. In terms of mediator variables, disorganization, persistence and effort were all validated as joint mediators. Persistence and effort mediated the relationship between performance-approach goals and exam performance, while disorganization mediated the relationship between performance-avoidance and exam performance. Results on gender show a significant positive relationship with mastery goals and disorganization and a significant negative relationship with SAT scores. Information on how gender was coded was not mentioned in this study; therefore the direction of this relationship is unknown

In conclusion, these results support the hypotheses associated with the trichotomous achievement goals framework. Mastery goals were positive predictors of deep processing, persistence, and effort, while performance-approach goals were positive

predictors of surface processing, persistence, effort, and exam performance. Lastly, performance-avoidance goals were positive predictors of surface processing and disorganization and negative predictors of deep processing and exam performance. Persistence and effort were mediators between performance-approach goals and exam performance, and disorganization mediated between performance-avoidance and exam performance, while gender had a significant negative relationship to performance approach goals.

Ablard and Lipschultz (1998) studied the relationship between achievement goals and self-regulated learning (SRL) in seventh grade students. The participants were chosen on the basis of a score in the top 3% on either the California Achievement test, Comprehensive Test of Basic Skills, or the Metropolitan Achievement test. Each participant was required to fill out the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Maninez-Ponds, 1986), which required them to explain the methods they use in eight different contexts: remembering information from class discussions, completing a short paper, completing math homework containing a problem that is not understood, checking homework assignments, preparing for a test in reading or writing, taking a test, completing homework with distractions, and studying at home. Participants were also required to rate, on a Likert scale, how often they used these strategies, ranging from (1) seldom to (4) most of the time. The Task-Orientation and Ability-Orientation scales of the Patterns of Adaptive Learning Survey (PALS; Midgley, Maehr, Hicks, Roeser, Urda, Anderman, & Kaplan, 1996) were used to measure mastery and performance goal orientations. Statements for these scales are on a 5-point Likert

scale and ranged from (1) not true at all of me to (5) very true of me. SAT scores from all participants were also obtained.

A MANOVA was conducted in order to determine if there were gender differences in achievement goals. Gender was significantly related to achievement goals, with females scoring stronger on mastery goals than males. Females also had a significantly higher SRL total than males. More specifically, it was found that females reported significantly higher use of the following strategies: organizing and transforming, goal setting and planning, keeping records and monitoring, seeking assistance from peers, and reviewing notes. Gender differences also varied depending on the learning context. Females reported a greater use of SRL strategies than males in a number of difference situations. This includes writing a short paper, completing a math problem they did not understand, preparing for reading and writing tests, and when having difficulty completing assignments because of other distracting activities.

Overall, it appears that females report more frequent use of self-regulated learning strategies, have higher mastery goals, and report more frequent use of the types of strategies that make the best use of the immediate environment or personal regulation (Ablard & Lipschultz, 1998). Females also tended to use these strategies more frequently in certain situations, more specifically, in both verbal learning situations, when writing a paper or preparing for a reading or writing test, females reported higher use than males.

Achievement goals will be measured in the current study. It is predicted that mastery and performance-approach goals will be positively related to note quality, while performance-avoidance goals will be negatively related to note quality. It is also predicted that gender differences in achievement goals will exist, with females being

more likely to have a mastery goal orientation than males. Therefore female's goal orientation will most likely be related to note quality. Given the research, it is predicted that performance-approach goals will continue to be positively related to test performance, while performance-avoidance goals will be negatively related. Mastery goals are also predicted to have a positive relation to test performance.

Conclusion

The act of note-taking is clearly a multifaceted strategy that proves to be an effective means of acquiring and remembering information presented in lecture format. Because a number of different skills and components are necessary in order to be an effective note-taker, it is important that all possible contributors are examined in order to determine how individual differences can affect this process. Having chosen gender as my variable of interest, I have extensively reviewed the available literature on gender differences in order to find those variables in which differences have been found as well as if these variables have any relationships to note-taking or to the processes involved. The cognitive variables found to be typically associated with expertise in studying are transcription speed, working memory, and verbal ability, with transcription speed also being related to gender differences. In addition, conscientiousness has been shown to be related to academic success as well as to gender differences in academic performance. Finally, academic goal orientation has also been demonstrated to be related to differences in academic achievement and occasionally has been found to be related to gender.

Hypotheses

The purpose of the current study is to investigate gender differences in note-taking based on the roles that both cognitive and motivational factors play in relation to

note quality. The relationship between these factors and written recall is also a primary focus of this study.

Females are predicted to score higher on transcription fluency, with females demonstrating a higher transcription speed. It is also thought that gender differences in conscientiousness will exist, whereas females will demonstrate a higher level of conscientiousness than their male counterparts. Females are predicted to score higher on verbal ability, with females obtaining higher scores on a task measuring reading comprehension skills. Achievement goals are also predicted to vary; females will more likely have a mastery goal orientation. No gender differences are anticipated on the working memory task. Gender is expected to be significantly and positively related to notes, where females will demonstrate higher quality notes than their male counterparts. In addition, it is predicted that females will score higher on written recall; however this relationship will be mediated by note quality.

Conscientiousness and working memory will be significantly and positively related to quality of notes. Working memory is expected to underlie note quality, with a greater working memory capacity also leading to higher quality of notes. Transcription fluency and verbal ability are also expected to be significantly and positively related to quality of notes, with a faster transcription speed and more proficient verbal ability leading to a higher quality of notes. Achievement goals are predicted to be related to quality of notes; mastery goals and performance-approach goals being related to higher quality of notes and performance-avoidance goals being related to a lower quality of notes.

Transcription fluency and working memory will most likely not have a direct effect on written recall; in this case notes will mediate the relationship, as quality of notes has been found to be a significant predictor of test performance. Reading comprehension ability, conscientiousness, and goal orientation are predicted to have some positive direct influence on written recall.

Chapter 3

Method

Participants

Participants were undergraduate students (N =139) from a large public university located in the northeastern United States. The mean age of the sample was 19.7 (SD= 1.8), with ages ranging from 17-29; mean age of females was 19.6; mean age of males was 19.8. Fifty-five percent were reportedly female and 45% were male. Ninety-one percent spoke English as their first language. The race/ethnicity breakdown for the sample was as follows: forty percent were White (N=55), thirty-two percent were Black/African American (N=44), fourteen percent were Asian American/Pacific Islander (N=20), five percent Latina/Latino (N=7), four percent were Native American/Alaskan Native (N=5) and six percent were Other (N=8). Ethnic groups were also broken down by gender, 47% of females were White, 26% were Black/African American, 13% were Asian American/Pacific Islander, 6% were Latina/Latino, 3% were Native American and 4% were Other, as opposed to the males, which were made up of 30% White, 38% Black/African American, 16% Asian American/Pacific Islander, 3% were Latina/Latino, 5% were Native American and 8% were Other. Ethnic breakdowns for females and males were not equivalent; females had a significantly higher population of White students, while males had a significantly higher population of Black/African American students. The United States Census' national population estimates for gender statistics reported 49% males and 51% females in 2008. However, the ethnicity statistics of the sample in this study were more diverse than the reported current population in the United States: White (72.4%), Black/African American (12.8%), Asian (4.8%), American

Indian/Alaskan Native (0.9%), Hispanic/Latino (16.3%) and Other (6.2%) (U.S. Census Bureau, 2011).

Participants were compensated by extra course credit as approved by the university's IRB. Of the 139 individuals that participated, all 139 valid protocols were used in this dissertation. Administration of tasks took place in a large classroom with the use of an electronic overhead projector and associated speaker system. The directions and videotaped lecture were adjusted to adequate audio and visual levels to ensure that all participants could properly hear and see pertinent information.

Materials and Scoring

The materials consisted of a previously recorded lecture video on the psychology of problem solving, measures of transcription fluency (alphabet task), verbal working memory (the operation span task), reading comprehension ability (The Nelson Denny), conscientiousness (NEO-PI-R) and motivational goal orientation (Achievement Goal Questionnaire). All tasks were group administered. Inter-rater agreement in scoring was established for the aforementioned measures by random selection of ten protocols, which were scored by two different raters. Analyses using Pearson correlations were conducted in order determine inter-rater agreement.

Transcription Fluency. Transcription fluency was measured using a modified version of the Alphabet Task, which was based on the one created by Berninger et al. (1991). Participants were asked to write the letters of the alphabet across the page, in order (A through Z), as many times as they could within a 60 second time limit. Participants were instructed to write the letters in capital case form first, followed by lower case form, and alternating between these two different forms until time was up.

As long as these specific instructions are followed, all letters were considered correct as long as they were legible. One point was awarded for each letter written and all points were added to calculate the participant's total score for the task. Interrater agreement in scoring for this task on the aforementioned random 10 protocols was 1.0. See Appendix A.

Working Memory. Working memory was measured using Turner and Engle's (1989) operation span task. During this task participants were presented with blocks of math equations (e.g., $IS\ 2 + 3 = 6?$) that ranged in number from two to five. After the presentation of each equation, participants were immediately presented with a word (e.g. CLOUD). During the presentation of the equations, participants were required to verify whether or not the equations they saw were mathematically correct, by writing "Y" for "yes" or "N" for "no" in their individual packets. After the entire set of equations was completed, the participants were required to turn the page and recall and write down all of the words they heard within that set. Scoring for this task was based on the highest level in which participants were able to remember all of the words for at least one of the three given equation sets. Therefore if the participants were able to remember all of the last words for two to three of the equation sets on level 5, their span level would be a 5. However, if they could only remember the words for one set of equations on level 5, their span would be the number of words in that set minus 0.5 (4.5). Therefore the range of scores was 1.5 to 5 with increments of 0.5. Interrater agreement in scoring was .975. See Appendix B.

Verbal Ability. Verbal ability was assessed using the Comprehension section of the Nelson-Denny Test, Form G (Brown, Bennett & Hanna., 1981). The Nelson Denny

is a widely used assessment tool for measuring reading and comprehension skills in individuals ranging from high school age to adult. The Comprehension section of the Nelson-Denny is made up seven reading passages in addition to a total battery of 38 questions pertaining to these specific passages. The questions are in multiple-choice format with five answer options for each question. Formal test administration procedures allow a total of 20 minutes for the Comprehension section; however other studies have employed a 15 minute limit in order to increase the variance in participants' performance, allowing for better discrimination between good and poor comprehenders (Perfetti, 1986). The same time procedure was used in the current study. The participants' total comprehension score consisted of the raw total of comprehension questions answered correctly. Reliability analysis of this measure produced a Cronbach's alpha of .92.

Conscientiousness. Conscientiousness was measured by the Conscientiousness subscale of the NEO Personality Inventory – Revised (NEO-PI-R) - Form S (Costa & McCrae, 1992). This inventory assesses five domains of personality and assesses 30 more specific traits, six traits within each of the five domains. The five domains include Neuroticism, Agreeableness, Conscientiousness, Emotional Stability, and Openness to Experience. Individuals were administered the Conscientiousness subscale of the NEO-PI-R self-report version which includes 48 personality items. Answers to items are based on a likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Examples of items include “I waste a lot of time before settling down to do work” and “My work is likely to be slow but steady”. Total scores for each domain are calculated as well as scores for each of the facets. Domain level reliabilities range from .86 to .95, while facet level reliabilities range from .56 to .90. Construct, convergent and divergent validity

evidence of the scales has also been demonstrated. Total administration time for the Conscientiousness subscale was 6 to 8 minutes. Internal consistency for this measure was $\alpha=.89$

Motivational Goal Orientation. Participants' were administered the Achievement Goal Questionnaire (AGQ) developed by Elliot and Church (1997). This is an 18 item assessment based on Ellis' 3 factor achievement model. Six questions make up each of the 3 subscales (mastery, performance-avoidance, and performance-approach) which are all rated on a 7-point likert scale ranging from 1 (not very true of me) to 7 (very true of me). The reported reliability alphas for the measures of mastery, performance-approach and performance-avoidance goals were respectively .89, .91 and .77 based on a sample of 204 undergraduates enrolled in a psychology course at the University of Rochester (Elliot & Church, 1997). Examples of items include, "It is important for me to understand the content of this course as thoroughly as possible" (mastery), "I just want to avoid doing poorly in this class" (performance-avoidance) and "It is important for me to do better than the other students" (performance-approach). Measures of internal consistency demonstrated alphas of .96, .88, and .92 for performance approach, mastery, and performance avoidance respectively.

Scoring of Notes and Free Recall. The lecture and the specific scoring procedures used in this study were based on that devised by Brobst (1996). This particular lecture has been utilized in other research by Peverly et al. (2007). Participants' notes were scored based on quality. The quality scores range from 0 to 3 points for each of the 15 topics mentioned. If the topic was not mentioned or the information was incorrect, 0 points were awarded, if the topic was merely mentioned it received 1 point, if the topic

was mentioned and included a partial explanation it received 2 points, and if the topic was mentioned and included a complete explanation it received the full 3 points. Total quality scores therefore ranged from 0 to 45. See Appendix C for example notes and Appendix D for example scoring sheet. Interrater agreement for scoring of note quality was .985.

Written Recall. Students were instructed to write an organized summary based on the videotaped lecture without the use of their written notes. The same procedure, devised by Brobst (1996), which was used to score the lecture notes was used for scoring the written recall. Participants' summaries were also scored based on quality. The quality scores range from 0 to 3 points for each of the 15 topics mentioned. If the topic was not mentioned or the information was incorrect, 0 points were awarded, if the topic was merely mentioned it received 1 point, if the topic was mentioned and included a partial explanation it received 2 points, and if the topic was mentioned and included a complete explanation it received the full 3 points. Total quality scores for essay portion also ranged from 0 to 45. For this task, they were given a 15-minute time limit and a two-sided blank piece of paper. Interrater agreement for scoring of written recall was 1.0.

Procedures

Participants were given a packet of testing materials including a consent form, approved by the Teachers College Institutional Review Board, which outlines the purpose, procedures, and time involved in the study, as well as the participants' rights as members of society. If they agreed to take part in the study and sign the consent form, they were instructed to turn the page and fill out a brief demographics questionnaire. Once they had completed the questionnaire, the group was told to watch and take notes

on a 20-minute videotaped lecture on the psychology of problem solving. The packet they received included a two-sided blank sheet of paper that they were to take notes on. They were also told that later in the study they would have 10 minutes to look over and study their notes and therefore they should take as complete notes as possible.

Directions for the alphabet task were presented next and participants were given 60 seconds to complete this task. Participants were told to work as quickly as possible on this task. This task was followed by the completion of the Operation Span Task. In this task, the participant was presented with blocks that contained multiple trials in which a mathematical operation was presented and followed seconds later by a one-syllable noun (e.g., $3 + 1 = 6$?/CLOUD). The participant was required to read the equation, verify its correctness by writing either “Y” for “Yes” or “N” for “No” on a sheet in their packets, and remember the word for later recall. Blocks consisted of two to five trials. After all of the equations and words for the trial were presented, participants heard a beep, signaling that the block was complete and they were to turn the page and write down all of words they could recall in the order that they were presented. Practice items were administered and reviewed prior to administration of this test. Approximate time to complete this task was 15 minutes.

The Nelson-Denny was administered next. The directions were read from the administration manual; however they were altered, as participants were not required to record their reading speed. Participants were given a total of 15 minutes to complete this task and were informed repeatedly as to the time remaining (e.g. 10, 5, 1 min(s)). A five-minute break was given after the completion of this task.

After the break, participants completed the Conscientiousness scale of NEO-PI-R. Instructions were found in the participants' packets. Participants were instructed to follow along with the instructions in their packets as they were read aloud. Participants did not have a time limit on this task, however the task generally took between 10 and 15 minutes to complete. After completion of the NEO-PI-R, participants were then informed that they had 10 minutes to go back and review their notes. After the 10-minute time limit was up, the participants were instructed to turn the page and complete the Achievement Goal Questionnaire (AGQ). Instructions were read aloud by the administrator and participants were instructed to answer the items as best as they could.

Finally, participants were given 15 minutes to complete the written recall task. They were provided with one double-sided piece of blank paper allowing for optional space to write an outline or to take notes before composing the summary. Participants were told to write an organized summary of the information that was presented to them in the lecture. They are also informed that only the information in the summary would be counted as correct. Participants were also reminded of the remaining time throughout this task. The total time for this study, including the 5-minute break, was approximately 90 minutes.

Chapter 4

Results

This dissertation investigated a number of hypotheses regarding gender and the cognitive and motivational factors related to note-taking. Females were predicted to have significantly higher scores than males on measures of transcription fluency, conscientiousness, verbal ability, mastery goal orientation, note quality and written recall. Also, it was hypothesized that gender, transcription fluency, verbal ability, conscientiousness, working memory, mastery orientation and approach orientation would all have a significant, positive relationship to quality of notes. Avoidance orientation was predicted to have a significant negative relationship to note quality. Furthermore, in addition to notes, verbal ability, conscientiousness and goal orientation were predicted to have a significant, positive relationship to written recall.

A one-way MANOVA revealed a significant main effect for gender, Wilks' $\lambda = .724$, $F(9,126) = 5.34$, $p < .001$, partial eta squared = .276. Power to detect effect was 1.00. Given the significance of the overall test, the univariate main effects were examined. As predicted, significant univariate main effects for gender were obtained for transcription fluency ($F = 9.50$, $p = .002$), verbal ability ($F = 9.50$, $p = .002$), conscientiousness ($F = 12.38$, $p = .001$), note quality ($F = 25.01$, $p < .001$), and written recall ($F = 8.29$, $p = .005$), with females scoring higher than males. Unexpectedly, females also had higher working memory scores than males, ($F = 9.10$, $p = .003$). The main effects for approach ($F = 1.42$, $p = .24$), mastery ($F = 2.38$, $p = .13$), and avoidance goal orientations ($F = .04$, $p = .85$) were not significant. Means and standard deviations

for each of the independent and dependent variables, broken down by gender, are in Table 1.

Intercorrelations among the independent and dependent variables are in Table 2. Gender was significantly related to transcription fluency ($r=-.24, p<.01$), working memory ($r=-.31, p<.01$), verbal ability ($r=-.26, p<.01$), conscientiousness ($r=-.30, p<.01$), note quality ($r=-.40, p<.01$) and written recall ($r=-.25, p<.01$). Note quality was found to be significantly related to working memory ($r=.28, p<.01$), verbal ability ($r=.48, p<.01$) and written recall ($r=.64, p<.01$). In addition to note quality, written recall was significantly related to verbal ability ($r=.36, p<.01$), conscientiousness ($r=.22, p<.01$), mastery orientation ($r=.23, p<.01$), and note quality ($r=.64, p<.01$).

Intercorrelations, broken down by gender, are demonstrated in Table 3 and 4. Note quality and written recall were significantly correlated for both groups of participants, with males ($r=.61, p<.01$) having a stronger correlation than females ($r=.30, p<.05$). Note quality was also significantly correlated with working memory ($r=.23, p<.05$) and verbal ability ($r=.49, p<.01$) for females. Similarly, note quality was correlated with verbal ability ($r=.32, p<.05$) for males but not working memory ($r=.13, p>.05$). Written recall was significantly correlated with transcription fluency ($r=.30, p<.01$), verbal ability ($r=.39, p<.01$), and conscientiousness ($r=.30, p<.01$) for females. However written recall was not correlated with measures of transcription fluency ($r=-.08, p>.05$), verbal ability ($r=-.19, p>.05$) or conscientiousness ($r=-.09, p>.05$) for males.

Notes' quality

Interactions between gender and each of the independent variables were separately regressed on note quality. All continuous variables were centered for the

Table 1
Means and Standard Deviations by Gender

Variables	<i>Females</i>		<i>Males</i>		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Note Quality	9.34	5.65	5.27	3.00	25.01***
Written Recall	3.49	3.00	2.19	1.91	8.29**
Transcription Fluency	109.70	22.81	97.52	26.20	9.50**
Working Memory	4.44	.67	3.96	.84	9.10***
Verbal Ability	21.68	9.34	16.90	8.68	9.50**
Conscientiousness	128.57	21.03	115.40	20.59	12.38***
Approach	14.96	4.68	13.86	4.67	1.42
Mastery	17.92	3.44	16.73	4.22	2.38
Avoidance	11.75	6.15	11.87	5.17	.04

Note. Approach = Approach Orientation; Mastery = Mastery Orientation; Avoidance = Avoidance Orientation.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2
Intercorrelations Among the Independent and Dependent Variables

Variables	1	2	3	4	5	6	7	8	9	10
1. Note Quality	—									
2. Written Recall	.64**	—								
3. Trans. Fluency	.18**	.18*	—							
4. Working Memory	.28**	.43**	.14	—						
5. Verbal Ability	.48**	.36**	.21**	.17*	—					
6. Conscientiousness	.20*	.22**	.18	.20*	.07	—				
7. Approach	.13	.05	.15	.08	.20*	.31**	—			
8. Mastery	.11	.23**	-.04	.07	.03	.42**	.27**	—		
9. Avoidance	-.05	-.21**	.05	.04	-.10	-.35**	.09	-.18*	—	
10. Gender	-.40**	-.25**	-.24**	-.31**	-.26**	-.30**	-.12	-.16	.01	—

Note. Trans. = Transcription; Approach = Approach Orientation; Mastery = Mastery Orientation; Avoidance = Avoidance Orientation.

* $p < .05$. ** $p < .01$.

Table 3

Intercorrelations Among the Independent and Dependent Variables for Female Participants

Variables	1	2	3	4	5	6	7	8	9
1. Note Quality	—								
2. Written Recall	.30**	—							
3. Trans. Fluency	.21	.30**	—						
4. Working Memory	.23*	.19	.16	—					
5. Verbal Ability	.49**	.39**	.36**	.04	—				
6. Conscientiousness	.15	.30**	-.05	.08	.06	—			
7. Approach	.15	.09	.13	-.09	.16	.25*	—		
8. Mastery	.01	.25*	-.03	.02	.00	.32**	.06	—	
9. Avoidance	-.06	-.23*	-.02	-.16	-.12	-.53**	.00	.32**	—

Note. Trans. = Transcription; Approach = Approach Orientation; Mastery = Mastery Orientation; Avoidance = Avoidance Orientation.
* $p < .05$. ** $p < .01$.

Table 4

Intercorrelations Among the Independent and Dependent Variables for Male Participants

Variables	1	2	3	4	5	6	7	8	9
1. Note Quality	—								
2. Written Recall	.61**	—							
3. Trans. Fluency	-.15	-.08	—						
4. Working Memory	.13	-.08	.06	—					
5. Verbal Ability	.32*	.19	-.06	.16	—				
6. Conscientiousness	-.04	-.09	-.07	.16	-.10	—			
7. Approach	-.03	-.11	.12	.18	.19	.34**	—		
8. Mastery	.14	.15	-.13	.04	-.02	.48**	.45**	—	
9. Avoidance	-.02	-.18	.15	.28	.02	-.13	.22	.04	—

Note. Trans. = Transcription; Approach = Approach Orientation; Mastery = Mastery Orientation; Avoidance = Avoidance Orientation.
* $p < .05$. ** $p < .01$.

purpose of these analyses. The interaction between gender x transcription fluency was found to be significant ($\beta = -.25, p < .05$), as well as the interaction between gender x reading comprehension ability ($\beta = -.22, p < .05$). No other interactions were found to be significant. Given the significance of the two interactions, data from this study was analyzed using forced entry hierarchical regression analyses. In the first analysis, notes quality was regressed on gender, transcription fluency, working memory, verbal ability, NEO-PI-R Conscientiousness subscale, and Achievement Goal Orientations in the first block and all of the significant interactions between gender and the other independent variables in the second block: gender x transcription fluency and gender x reading comprehension ability. The regression equation was significant for Model 1 (tolerance and variance inflation factor values were within acceptable limits; $R = .58, R^2 = .34, R^2_{\text{adjusted}} = .30, p < .001$) (this effect size is large; Cohen, 1992) and Model 2 ($R = .61, R^2 = .37, R^2_{\text{adjusted}} = .32, p = .05$). The R^2_{change} from Model 1 to Model 2 was significant ($R^2_{\text{change}} = .03, p = .05$).

In Model 1, as expected, gender ($\beta = -.23, p < .01$) and verbal ability ($\beta = .40, p < .001$) were significant predictors of note quality. Contrary to expectation, transcription fluency ($\beta = .03, p > .05$), working memory ($\beta = .12, p > .05$), conscientiousness ($\beta = .07, p > .05$), mastery orientation ($\beta = .02, p > .05$), approach orientation ($\beta = -.03, p > .05$) and avoidance orientation ($\beta = .02, p > .05$) were not significant predictors of note quality. In Model 2, verbal ability ($\beta = .54, p < .000$), gender ($\beta = -.26, p < .01$), and the gender x verbal ability interaction were significant ($\beta = -.23, p < .05$). See Table 5. Subsequent analyses of the simple effects demonstrated that differences in notes among males and females who were low in verbal ability were not significant ($t(69) = 1.84, p > .05$). However, among

students who scored high in verbal ability, females' notes were superior to males ($t(66) = 4.335, p < .001$). Also, females with high verbal scores produced significantly better notes than those with low verbal scores ($t(74) = 4.95, p < .001$). However, there were no differences in notes among males who were high and low in verbal ability ($t(61) = 1.44, p > .05$). See Figure 1.

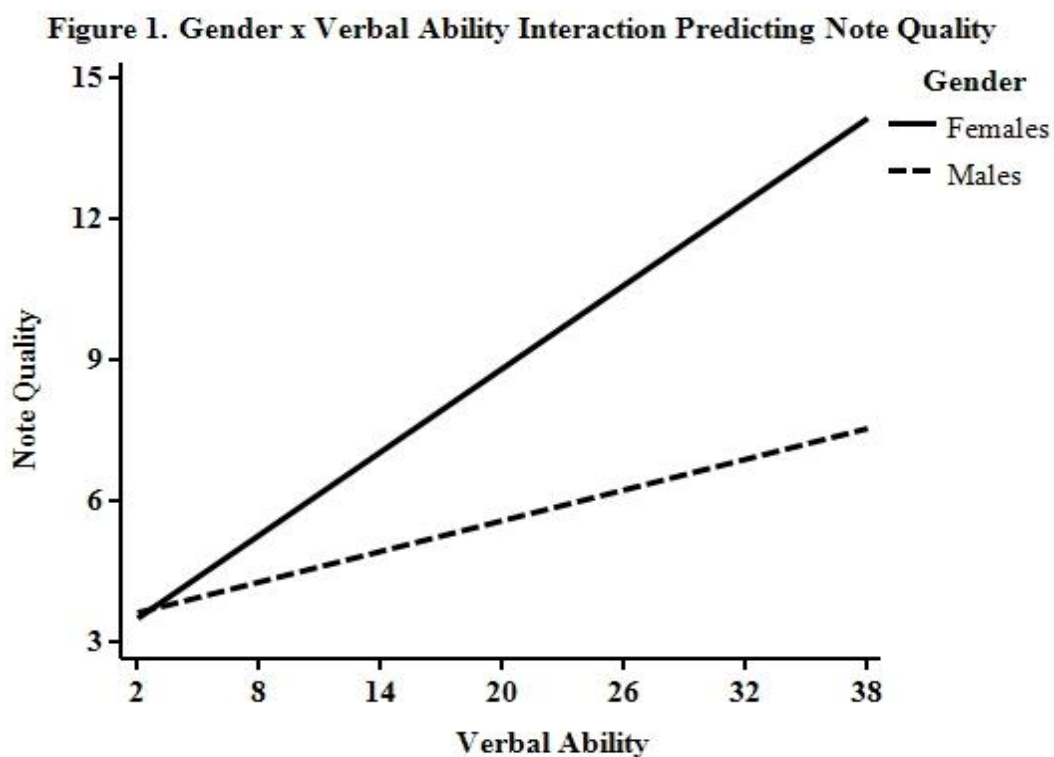


Table 5

Summary of Hierarchical Regression Analyses Predicting Note Quality with Interaction terms for Gender, Transcription Fluency, and Reading Comprehension

Variable	<i>B</i>	<i>SE B</i>	β	Partial <i>r</i>	Tolerance	VIF
Model 1						
Transcription Fluency	.01	.84	.03	.03	.89	1.13
Working Memory	.79	.50	.12	.14	.87	1.16
Verbal Ability	.22	.04	.40***	.42	.86	1.16
Conscientiousness	.02	.02	.07	.07	.62	1.61
Approach Orientation	-.03	.09	-.03	-.03	.79	1.27
Mastery Orientation	.03	.11	.02	.02	.81	1.24
Avoidance Orientation	.01	.07	.02	.02	.79	1.27
Gender	-2.34	.84	-.23**	-.24	.77	1.30
Model 2						
Transcription Fluency	.01	.02	.03	.03	.40	2.52
Working Memory	.90	.49	.14	.16	.85	1.17
Verbal Ability	.30	.06	.54***	.42	.47	2.15
Conscientiousness	.01	.02	.06	.06	.62	1.62
Approach Orientation	-.02	.09	-.02	-.02	.79	1.27
Mastery Orientation	.03	.12	.02	.02	.81	1.24
Avoidance Orientation	.03	.07	.03	.03	.78	1.28
Gender	-2.61	.83	-.26**	-.27	.76	1.32
Gender x Transcription Fluency	-.02	.03	-.07	-.20	.51	1.96
Gender x Verbal Ability	-.20	.09	-.23*	-.06	.44	2.28

Note. $\Delta R^2_{change} = .34$, $R=0.58$, $R^2 = 0.34$, $R^2_{adjusted}=0.30$ for Model 1. $\Delta R^2_{change} = .03$, $R=0.61$, $R^2 = 0.37$, $R^2_{adjusted}=0.32$ for Model 2.

VIF=Variance Inflation Factor.

* $p < .05$. ** $p < .01$. *** $p < .00$.

Written recall

Interactions between gender and each of the independent variables, including notes, were regressed on written recall. All continuous variables were centered for the purpose of these analyses. The gender x transcription fluency ($\beta = -.31, p = .01$) and gender x conscientiousness ($\beta = -.27, p < .05$) interactions were significant. None of the other interactions were significant. A second hierarchical regression was performed, where written recall was regressed on all of the aforementioned variables, including note quality, in the first block and the significant interactions, gender x transcription fluency and gender x conscientiousness, in the second block. The regression equation for Model 1 was significant (tolerance and variance inflation factor values were within acceptable limits; $R = .69, R^2 = .47, R^2_{adjusted} = .43$), $F(9, 135) = 12.44, p < .001$ (the effect size, with R^2 used as an estimate of effect size, was large; Cohen, 1992). The regression equation for Model 2 was also significant ($R = .70, R^2 = .50, R^2_{adjusted} = .45, p = .05$). The R^2_{change} from Model 1 to Model 2 was significant ($R^2_{change} = .03, p = .05$).

In Model 1, consistent with expectations, note quality ($\beta = .58, p < .001$) was a significant predictor of written recall. In addition, transcription fluency ($\beta = .14, p = .05$) and Mastery goal orientation ($\beta = .15, p < .05$) were also significant predictors of written recall. Gender ($\beta = .05, p > .05$), verbal ability ($\beta = .12, p > .05$), and conscientiousness ($\beta = .03, p > .05$) were not found to be significant predictors of note quality, which was unexpected. In Model 2, note quality ($\beta = .56, p < .001$), transcription fluency ($\beta = .23, p < .05$), mastery orientation ($\beta = .17, p < .05$) and the gender x conscientiousness interaction were found to be significant ($\beta = -.20, p < .05$). See Table 6. Subsequent analyses demonstrated that the differences in written recall among males and females

who had low conscientiousness scores were not significant ($t(69) = 1.70, p > .05$).

However, among students who scored high in conscientiousness, females' written recall was superior to males ($t(66) = 2.07, p < .05$). Females with high conscientiousness did not score significantly better on written recall scores than those with low conscientiousness ($t(74) = 1.21, p > .05$). Similarly, there were no differences in written recall among males who had high and low conscientiousness scores ($t(61) = .321, p > .05$).

See Figure 2.

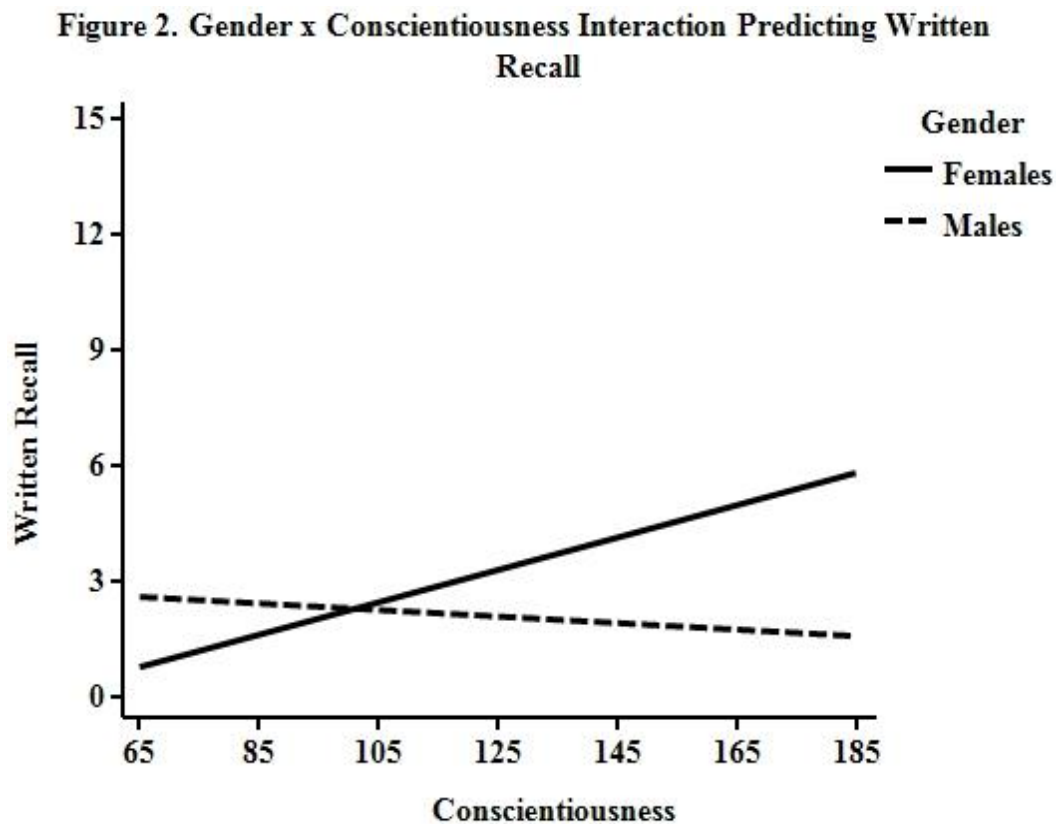


Table 6

Summary of Hierarchical Regression Analyses Predicting Written Recall with Interaction terms for Gender, Transcription Fluency, and Conscientiousness

Variable	<i>B</i>	<i>SE B</i>	β	Partial <i>r</i>	Tolerance	VIF
Model 1						
Note Quality	.30	.04	.60***	.55	.66	1.51
Transcription Fluency	.01	.01	.14*	.17	.89	1.13
Working Memory	-.14	.24	-.04	-.05	.85	1.18
Verbal Ability	.02	.02	.08	.09	.71	1.41
Conscientiousness	.00	.01	.03	.03	.62	1.61
Approach Orientation	-.06	.04	-.10	-.12	.79	1.27
Mastery Orientation	.11	.05	.15*	.18	.81	1.24
Avoidance Orientation	-.06	.03	-.13	-.16	.79	1.28
Gender	.28	.40	.05	.06	.73	1.38
Model 2						
Note Quality	.29	.04	.56***	.53	.65	1.54
Transcription Fluency	.02	.01	.23*	.21	.42	2.38
Working Memory	-.11	.23	-.03	-.04	.85	1.18
Verbal Ability	.02	.02	.06	.07	.68	1.46
Conscientiousness	.02	.01	.18	.15	.38	2.65
Approach Orientation	-.06	.04	-.10	-.12	.79	1.27
Mastery Orientation	.12	.05	.17*	.21	.79	1.27
Avoidance Orientation	-.04	.03	-.09	-.11	.74	1.35
Gender	.19	.40	.04	.04	.72	1.39
Gender x Transcription Fluency	-.02	.02	-.13	-.12	.44	2.28
Gender x Conscientiousness	-.04	.02	-.20*	-.19	.49	2.06

Note. $\Delta R^2_{change} = .47$, $R=0.69$, $R^2=0.47$, $R^2_{adjusted}=0.43$ for Model 1. $\Delta R^2_{change} = .03$, $R=0.70$, $R^2=0.50$, $R^2_{adjusted}=0.45$ for Model 2.

VIF=Variance Inflation Factor

* $p<.05$. ** $p<.01$. *** $p<.001$

To further explore the relationship of gender to note quality and written recall, regressions were run independently for females and males. First, note quality was regressed on all of the independent variables, for females only. The regression equation was significant ($F(7, 74) = 4.48, p < .001$). Only working memory ($\beta = .22, p = .04$) and verbal ability ($\beta = .50, p < .001$) significantly predicted females' note quality. Next, note quality was regressed on all of the independent variables, for males only. The regression equation was not significant ($F(7, 60) = 1.6, p > .05$). See Table 7. Additionally, written recall was regressed on all of the independent variables, including note quality, for females only. The regression equation was significant ($F(8, 74) = 7.78, p < .001$). Note quality ($\beta = .50, p < .001$) and mastery goal orientation ($\beta = .19, p < .001$) were the only significant predictors of written recall. Written recall was then regressed on all of the same variables for males. The regression equation was significant ($F(8, 60) = 5.00, p < .001$). Note quality was the only significant predictor of written recall for male participants ($\beta = .57, p < .001$). See Table 8.

In summary, females had significantly higher scores on measures of transcription fluency, working memory, verbal ability, conscientiousness, note quality and written recall. When notes quality was regressed on the independent variables, gender, verbal ability and the gender x verbal ability interaction were significant. The gender x verbal interaction indicated that high reading comprehension skill is related to better quality of notes for females but not for males. Written recall was significantly predicted by notes quality, transcription fluency and mastery goal orientation. The interaction between gender and conscientiousness was also significant. The gender x conscientiousness interaction indicated that high conscientiousness scores are related to greater written

recall for females but not for males. When gender was analyzed separately, working memory and verbal ability significantly predicted note quality for females, while the regression equation was not significant for males. Note quality and mastery goal orientation were the only significant predictors of written recall for females, while note quality alone was the only significant predictor of written recall for males.

Table 7

Summary of the Regression Analyses Predicting Note Quality by Gender

Variable	Females			Males		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Transcription Fluency	.00	.03	.00	-.01	.02	-.06
Working Memory	1.86	.88	.22*	.50	.48	.14
Verbal Ability	.30	.07	.50***	.11	.05	.32
Conscientiousness	.05	.03	.17	-.02	.02	-.11
Approach Orientation	.05	.13	.04	-.12	.10	-.19
Mastery Orientation	.01	.18	.00	.16	.11	.22
Avoidance Orientation	.14	.12	.15	-.02	.08	-.03

Note. $R=0.57$, $R^2=0.32$, $R^2_{adjusted}=0.25$ for females. $R=0.42$, $R^2=0.18$, $R^2_{adjusted}=0.07$ for males.

* $p<.01$. ** $p<.05$. *** $p<.001$.

Table 8

Summary of the Regression Analyses Predicting Written Recall by Gender

Variable	Females			Males		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Note Quality	.26	.06	.50***	.37	.07	.57***
Transcription Fluency	.02	.01	.18	.01	.01	.08
Working Memory	.07	.42	.02	-.22	.26	-.10
Verbal Ability	.03	.04	.08	.01	.03	.05
Conscientiousness	.02	.02	.16	-.01	.01	-.12
Approach Orientation	-.05	.06	-.07	-.04	.05	-.11
Mastery Orientation	.16	.08	.19*	.07	.06	.15
Avoidance Orientation	-.02	.05	-.04	-.05	.04	-.15

Note. $R=0.70$, $R^2=0.49$, $R^2_{adjusted}=0.42$ for females. $R=0.66$, $R^2=0.44$, $R^2_{adjusted}=0.35$ for males.

* $p<.01$. ** $p<.05$. *** $p<.001$.

Chapter 5

Discussion

Lecture note-taking is an important study strategy used by a majority of college students to record important information presented in class. Research suggests that their time is well spent; the taking and reviewing of notes has been found to be associated with good test performance (Bretzing & Kulhavy, 1981; Fisher & Harris, 1973; Kiewra, 1985; Kiewra, et al., 1991; Kiewra & Fletcher, 1984; Peverly et al., 2003; Rickards & Friedman, 1978; Titsworth & Kiewra, 2004).

Research also suggests that there may be gender differences in note-taking and test taking. Some evidence indicates that females are better note-takers (Cohn et al., 1995; Cohn et al., 1990; Nye, 1978; Maddox & Hoole, 1975) and test takers (Kiewra, 1985b) than males. However, previous research on lecture note-taking has only examined gender differences, or used gender as an anecdotal variable, in post-hoc analyses. This is the first dissertation to investigate gender differences in lecture note-taking directly. More specifically, the primary purpose of this dissertation was to determine if gender differences in lecture note-taking exist, and if they do, to examine the cognitive and motivational variables that might explain them. A second purpose was to determine if there might be gender related differences in test performance. This research is an extension of research on lecture note-taking expertise (Peverly, et al., 2007), in which a reanalysis of their data found that females wrote faster than males, had higher quality notes, higher semantic retrieval scores, and performed better on written recall of the lecture (Reddington et al., 2006). In the current study undergraduate students took notes from a prerecorded lecture, and were later allowed to review their notes before taking a

test of written recall. The independent variables included transcription fluency, working memory, verbal ability, conscientiousness, and goal orientation. The dependent variables were note quality and written recall. A discussion of gender's relationship to note quality and written recall are presented first, followed by a discussion of possible reasons for gender related differences in some of the independent variables included in this study.

Note Quality

The analyses indicated that females took better notes than males and students with higher verbal ability took better notes than students with lower verbal ability. However, the analyses also indicated that low verbal males and females took notes of comparable quality and high verbal females took better notes than high verbal males. There were no significant differences between high and low verbal males in the quality of their notes. Although these data are consistent with prior research which suggests that females are better note-takers than males (Kiewra, 1985b; Cohn et al., 1995; Cohn et al., 1990; Nye 1978; Maddox & Hoole, 1975; Peverly et al., 2007) and verbal ability may be related to note-taking (Peverly & Sumowski, in press; Peverly, Vekaria, Reddington, Sumowski, Johnson, & Ramsay, in preparation) they are also considerably more nuanced in suggesting that the variables that predict females skills in note-taking may be different from those of males. In other words, for females, there is more to note-taking than verbal ability. In evidence, subsequent regression analyses by gender found verbal ability and working memory to be significant predictors of note quality for females (also, the MANOVA indicated that females had significantly higher working memory scores than males). In contrast, none of the independent variables were significant predictors of notes' quality for males. Although working memory has been hypothesized to be related

to note-taking (Peeverly, et al. 2007; Piolat, et al. 2005) previous research using complex span tasks of the type used in this study have not substantiated this. Future research on the relationship of cognitive and affective variables to gender-related differences in note-taking should attempt to replicate these findings. Also, there may be affective variables related to note-taking that were not measured or detected in this study such as gender-related perceptions of psychology. For example, over two-thirds of psychology majors are females (National Center for Education Statistics, 2010) and they may be more interested in psychology related information than males.

Contrary to expectations, none of the other variables significantly predicted note quality. However, verbal ability was highly correlated with note quality ($r=.48$), as well as transcription fluency ($r=.21$), and working memory ($r=.17$); all of which were significantly related to gender. Verbal ability was also significantly correlated with gender ($r=-.26$). Because verbal ability had the strongest correlation with notes of all the independent variables and was significantly correlated with many of them, the covariation of verbal ability with the other independent variables may have eliminated them from the regression equation.

The most surprising inconsistency in the results was the statistically nonsignificant relationship between transcription fluency and notes. In several previous studies on lecture note-taking (Peeverly, et al., 2007; Peeverly, Vekaria, Reddington, Sumowski, Johnson, & Ramsay, in preparation; Peeverly & Garner, in preparation) and text note-taking (Peeverly & Sumowski, in press), transcription fluency was found to be related to notes' quality. Also, in two of these studies there were a comparable number of men and women (Peeverly & Garner, in preparation; Peeverly & Sumowski, in press). A

possible reason for this discrepancy may include the time of day in which research data was collected. Participants were undergraduate students from two separate courses, held during evening hours, which may have affected their level of concentration and attention after a full day of other courses or activities. In addition, a large percentage of participants were male athletes, in the prime of football season, who may have suffered from high levels of physical exhaustion after early morning and afternoon hours of practice prior to participating in the study.

Measures of conscientiousness as well as mastery and performance-approach goals were predicted to be significantly and positively related to quality of notes. Performance-avoidance goals were predicted to be negatively related quality of notes. However, none of the affective independent variables utilized in this study were found to be significantly related to note quality. Regarding conscientiousness, Lievens et al. (2002) found that successful medical students had higher conscientiousness scores than unsuccessful medical students. Conscientiousness was also significantly related to medical students' final academic grades in each of their preclinical years. In addition, Vialle et al. (2005) found conscientiousness to be predictive of high school students' attitudes towards school and ratings of their own academic performance.

Similarly, research on achievement motivation has found a relationship between achievement goals and academic performance. Elliot et al. (1999), for example, found that performance approach goals were positively related to exam performance and performance avoidance goals were negatively related. There was no significant relationship between mastery goals and exam performance. Harackiewicz, Barron, Tauer, Carter, & Elliot (2000) found that students who adopted performance goals had

higher grades over the course of three subsequent semesters and that females in the sample obtained higher course grades over the following semesters than males. Grant and Dweck (2003) found that learning goals, often considered mastery goals by other researchers, positively predicted course grades, while other goal orientations were not significantly related to class performance.

Written Recall

Another purpose of this study was to examine the relationship of gender to test performance, as measured by written recall. The results of the MANOVA indicated that females wrote significantly more than males. The regression analysis, however, found that gender interacted with conscientiousness to predict written recall. Also, there were significant main effects for transcription fluency, mastery goal orientation and note quality.

The gender x conscientiousness interaction indicated that high conscientiousness is related to better test performance, as measured by written recall, for females but not for males. The differences in written recall among females and males with low conscientiousness were not significant. However, among students who scored high on conscientiousness, females were superior to males. Differences in written recall between females' low and high conscientiousness and between males' low and high in conscientiousness were not significant. As discussed in the previous section, research conducted by Lievens et al. (2002) found that conscientiousness scores were higher in successful medical students than unsuccessful medical students and that conscientiousness also significantly predicted final academic grades of medical students in each of their preclinical years. Gender was a significant covariate in the study,

however the direction was not specified. Vialle et al. (2005) found conscientiousness to be predictive of school attitude and a higher self-rating on academic performance in high school students. Females have also been found to score higher than males on measures of conscientiousness (Vialle et al, 2005; Nguyen, Allen & Fraccastoro, 2005). Therefore as anticipated, and as prior research has shown, a high level of conscientiousness appears to be important in predicting test performance, however this only applies to females in the present study.

Note quality, transcription fluency, and mastery goal orientation were also found to be significant predictors of written recall. Note quality was the strongest predictor of written recall, which supports the findings of previous research (Fisher & Harris, 1973; Kiewra et al., 1991; Peverly, et al., 2007; Peverly, Vekaria, Reddington, Sumowski, Johnson, & Ramsay, in preparation; Peverly & Garner, in preparation; Peverly & Sumowski, in press). Furthermore, subsequent regression analyses also found note quality to be the best predictor of written recall for females and males, independently. This result is not surprising, given that participants were allowed to study the lecture notes they took earlier in the study before partaking in the written recall measure. Research also indicates that students are much more likely to include information from notes in recall than information that was not included in notes (Rickards & Friedman, 1978). Therefore, the quality and content of the notes they recorded most likely influenced their written recall substantially.

The significant relationship between transcription fluency and written recall was a surprising result. In previous research on note-taking, transcription fluency has been significantly related to notes not written recall (Peverly, et al., 2007; Peverly &

Sumowski, in press; Peverly, et al., in preparation, Peverly & Garner, in preparation). However, this finding is consistent with research by Connelly & Barnett (2005) and Connelly et al. (2006) who found transcription fluency in undergraduates was related to both writing quality and quantity under realistic testing conditions. Similarly, research on writing among elementary and middle school students has suggested a relationship between transcription fluency and the quality of their written compositions (Graham, Berninger, Abbott, Abbott & Whitaker, 1997; Graham, Harris & Fink (2000) Jones & Christensen, 1999). In elementary students especially, transcription fluency is the strongest predictor of students' essay quality and quantity. Therefore transcription fluency appears to be an essential component of essay writing in both children and adults alike.

Mastery goal orientation was also found to be significant and positively related to written recall. This was consistent with expectations, as goal orientation was predicted to have some direct influence on written recall. On the one hand it is not surprising to find that those who possess higher mastery goal orientations, which are focused on the mastery of a task regardless of others' accomplishments, would perform better on a written recall task. On the other hand, this result is inconsistent with Elliot et al. (1999) who found mastery goals to be unrelated to test performance, though they were positive predictors of deep processing, persistence, and effort, all of which may be related to the task of written recall, which may help to explain this relationship. This same study also found performance approach goals to be positively related to test performance and performance avoidance goals to be negatively related to test performance. These findings are also inconsistent with present results, which did not find performance approach or

performance avoidance goals to be significant predictors of written recall. Therefore possessing a mastery goal orientation may have its advantages in how an individual prepares himself or herself to perform on a test or mastery goal may be related to test performance only in those situations where students are not preparing for a real test. Future research on note-taking may benefit from utilizing a real course lecture to more accurately assess the contribution of motivational variables to test performance.

Other Independent Variables

Results of this experiment found significant differences between females' and males' skills on measures of transcription fluency, working memory, verbal ability and conscientiousness. As predicted, females scored higher on the measure of transcription fluency, indicating faster transcription speed. This is consistent with previous research demonstrating females' superior advantages in transcription speed (Cohen, 1997; Lyle & Johnson, 1974; Lynn et al., 2005; Reddington et al., 2006; Slate, 1998). Perhaps this can be further explained by a female advantage in fine motor fluency, as measured by performance on the Perdue Pegboard task (Agnew, Bolla-Wilson, Kawas, & Bleeker, 1998; Strauss et al., 2006) and the Grooved Pegboard task (Bornstein, 1985; Ruff & Parker, 1993; Schmidt et al., 2000). On the Perdue Pegboard task, individuals are asked to place tiny pegs into holes on a board as quickly as they can. Female averages tended to run one-half to two or more points above the averages for males (Strauss et al., 2006). The Grooved Pegboard task requires more complex coordination than the Perdue Pegboard because of a ridge on the peg, which requires individuals to rotate it correctly into position. Females, on average, were 5 seconds faster at completing this task than

males (Bornstein, 1985). Therefore females may have a fine motor advantage, which allows them to complete these tasks faster than males.

In addition, the task utilized in the current study may contain a verbal component, given that letters, by their nature, are verbal symbols. In the reanalysis of three studies on lecture note-taking for the purpose of examining variables related to transcription speed, in all three studies, Peverly and Vekaria (in preparation) found that transcription speed was consistently predicted by two variables: fine motor fluency and speed of verbal access. Given the current findings on gender differences in verbal ability, which will be discussed shortly, this particular transcription task may have also given females an advantage over males.

Females were also found to have higher working memory spans than males (also, as mentioned previously, working memory was a significant predictor of note quality in females but not for males when regression analyses were run separately for each gender). This was an unexpected finding since prior research has not found significant differences between females and males' working memory. Although studies of gender differences in brain activation for language have found gender related differences in parts of the brain activated during working memory tasks, which appears to demonstrate that males and females use different strategies on working memory tasks (Shaywitz et al., 1995; Speck et al., 2000), differences in strategies do not necessarily translate into differences in working memory span. Further research on gender differences in working memory in the context of note-taking is needed to clarify this ambiguity.

In addition, females were found to have significantly higher scores on the measure of conscientiousness than males; this is consistent with hypotheses and prior

research on conscientiousness (Nguyen et al., 2005; Vialle et al., 2005). Vialle et al. (2005) found that females scored higher than males on a measure of conscientiousness, which was found to be predictive of school attitude and a higher self-rating on academic performance in high school students, which has been found to be related to academic outcomes among adolescents. Nguyen et al. (2005) also found significant gender differences in conscientiousness, favoring females. Further, this study found conscientious students were more likely to perform well in class than less conscientious students, and the correlation between conscientiousness and course grade and GPA to be positive and significant. Therefore females are more likely to be conscientious than males, which may help to predict achievement.

As mentioned previously, gender differences in verbal ability were also significant, with females scoring higher on a measure of reading comprehension. This is consistent with prior research indicating females' advantage over males in verbal ability (Halpern, 2000; Haynes & Waller, 1994; Martin & Hoover, 1987; NEAP, 2002). Martin and Hoover (1987), for example, explored gender differences in verbal ability in grades 3 through 8; overall females' outperformed males' on measures of spelling, capitalization, punctuation, language usage, and reading comprehension. In studies of college students, Hayes and Waller (1994) found females had higher scores on the Nelson Denny Reading Comprehension subtest (Brown et al., 1981) as well as on tasks of basic processing involving words or knowledge of words and the identification of letters.

In the current study, females were predicted to be more likely to have a mastery goal orientation than males. However, this prediction was not supported, which is inconsistent with research conducted by Ablard and Lipschultz (1998), which found

gender related to achievement goals, with females scoring significantly higher on mastery goals than males. Past research performed by Elliot, et al. (1999) also found that gender played a significant role in motivation, however information pertaining to how the variable was coded was not specified; therefore the direction of its relationship is unknown.

Educational Implications

The findings on the relationship of gender differences in cognitive and motivational variables to note quality and written recall may have important educational implications. Although prior research has found variables that contribute to skills necessary to take good lecture notes, no other study has specifically compared gender differences on these variables. The results of this study offer preliminary evidence that gender differences in cognitive and motivational variables exist, and that several of these variables help to predict quality of lecture notes as well as test performance.

Verbal ability was a significant predictor of note quality. Consequently, it can be assumed that verbal ability plays some role in being able to take meaningful notes. This suggests that primary and secondary school teachers should focus on teaching the acquisition of certain verbal skills necessary to take adequate notes, such as learning to identify main ideas. Additionally, transcription speed significantly contributed to predicting written recall and past research in note-taking has found a significant relationship between transcription fluency and notes. Research with children suggests that improving transcription speed through direct instruction helps to improve written essays (Brown, McDonald, Brown, & Carr, 1988; Connelly et al., 2005; Olive & Kellogg, 2002) and is important to adults when generating ideas (writing essays) and

recording them (taking notes). Therefore, students may benefit from direct instruction in note-taking skills as well as in transcription speed knowing that these skills affect test performance and writing. Perhaps males need more intensive instruction in areas related to verbal ability and transcription fluency.

Mastery goal orientation was also found to be significantly related to written recall. Since individuals with this type of motivational achievement goal are more concerned with the development of their own competence or mastery of a task regardless of others' accomplishments, it may be beneficial for teachers to stress the importance of mastering information taught in classrooms as well as the benefits of acquiring information for ones' personal knowledge rather than for attainment of high grades. Perhaps the emphasis in classrooms should shift away from grading and be based on one's ability to demonstrate mastery of a subject.

Limitations and Future Research

As with all research studies, there are limitations. In the present study, the sample only included undergraduates ranging in age from 17 to 29. Thus, the results of this study may not generalize to other populations. In addition, the participants were recruited from two courses held on campus during the evening hours. It is possible that students who prefer evening courses to courses held earlier in the day, may have different characteristics, traits, or even study habits. Therefore this sample may not be representative of typical undergraduates at a large public university and therefore the results may not be generalizable to this population.

The research on note-taking in the past few years has been extensive. However, research on gender differences in cognitive and motivational variables, as well as its

relationship to note-taking and test performance, is a relatively new area of research. Thus, more research on the relationship of gender to notes and tests needs to be conducted.

Due to the ever-changing uses of computers and technology, lecture note-taking may soon become less focused on the act of writing, or use of transcription fluency, and may soon be replaced with the act of typing or keyboarding on a laptop or other device in the classroom. This practice is already becoming increasingly popular among students. This process may rely on different cognitive and fine motor processes than the traditional note-taking we have become accustomed to. Therefore future studies may examine taking notes electronically rather than manually with the traditional pen and paper.

The pre-recorded lecture utilized for the purposes of this study consisted of an individual reading a lecture from a previously chosen script on the Psychology of Problem Solving. The individual did not use any type of visual aids in addition to his spoken word. Undergraduate lectures may use more visual cues, such as writing on a board, using transparencies, or showing power point presentations during a typical class. Students who are more inclined to learn with the assistance of visuals as opposed to solely auditory information may have more difficulty completing this task. Therefore the style of lecture utilized in this study may not be considered typical of present college discourses, which may be more multimodal in their approach to teaching. Therefore students who benefit from a visual approach to learning may have fared poorer on this measure of note-taking. Future research may include a lecture that includes more visual components or a variable that measures type of learner.

Even though working memory failed to predict quality of notes for males or written recall for both males and females in this dissertation, it is difficult to discount this variable. Further research in this area, which may allow for individual administration of a working memory measures would be advisable. Although administering tasks by group helps to control threats to internal validity, individuals who have difficulty sustaining attention or concentration may not perform as well in a group setting.

Although this dissertation accounted for approximately one third (37%) of the variance in lecture note-taking skill, there are two-thirds of the variance that have not been explained. Reading comprehension (i.e. verbal ability) was a significant predictor of note quality, its feasible that measuring other tasks associated with verbal ability, such as vocabulary and writing, may help to explain more of the variance than reading comprehension alone.

Conclusion

Lecture note-taking is an important study strategy. The primary goal of this dissertation was to explore possible gender differences in the variables, which underlie note-taking skill and test performance. Significant gender differences were observed on both of the dependent variables, note quality and written recall in favor of females. Females also performed significantly better on measures of transcription fluency, working memory, verbal ability, and conscientiousness. Note quality was significantly predicted by verbal ability, gender, and the gender x verbal ability interaction, while written recall was significantly predicted by transcription fluency, mastery goal orientation, and the gender x conscientiousness interaction. Future research should

continue to focus on examining potential gender differences on variables that may be associated with note-taking and test performance.

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Appendix A: Letter Fluency Task

You are going to take a test of your ability to write quickly. You will have 60 seconds to write all of the letters of the alphabet, in order from A-Z, as quickly as you can. First you will write the letters in CAPITAL form. When you finish the first complete alphabet in CAPITALS, begin a new alphabet in lower case letter. Continue writing the letters of the alphabet, alternating between CAPITALS and lower case, as quickly as you can until the experimenter tells you to stop. Use the space provided below to write the letters.

Again, you should write the letters of the alphabet, in order from A-Z, until I tell you to stop. Write the first complete set in CAPITALS, the second set in lower case, and so on alternating between the two.

Please wait for before you turn the page.

Appendix B: Operation Span Task

Operation Span Task

In the space below, write either Y=Yes or N=No as to whether the operation makes sense.

Practice

A) _____

B) _____

C) _____

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

11) _____

12) _____

DO NOT TURN THE PAGE UNTIL THE ENTIRE ITEM HAS BEEN SHOWN.

Operation Span Task

In the space below, please write the words, in order, that you saw after each operation.

Practice

A) _____

B) _____

C) _____

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

11) _____

12) _____

Appendix C: Scoring Criteria for Note Quality and Written Recall

Rater: _____	OUTLINE	Protocol _____	Notes	Essay
	I. Functions of Problem Solving in Education			
	A. Problem solving is a <u>cognitive activity</u> that is important to <u>educational theory</u> and <u>classroom practice</u> .		___/3	___/3
	B. Problem solving is considered part of learning <u>subject matter</u> . It serves a <u>testing</u> and <u>teaching</u> function.		___/3	___/3
	II. Definition of a Problem According to Information Processing Theory			
	A. "1) A problem is said to exist when an individual has a particular goal but is unable to obtain that goal. 2) It is frequently assumed that there is some type of obstacle or barrier that prevents the solver from reaching the goal. 3) These obstacles must, of necessity, be broadly defined and include such factors as failure to remember and lack of information." (<i>lack of skill and knowledge also acceptable</i>)		___/3	___/3
	III. Information Processing Approach			
	A. Information Processing Concepts			
	1. Problem Representation		___/3	___/3
	2. Goal States		___/3	___/3
	3. Constraints		___/3	___/3
	4. Problem States		___/3	___/3
	5. Operators		___/3	___/3
	6. Ill-Structured Problems		___/3	___/3
	B. Tower of Hanoi problem		___/2	___/3
	IV. Research Findings: Problem Solving in Particular Domains			
	A. "Chess" studies		___/2	___/3
	B. "Physics" studies		___/2	___/3
	V. Factors Involved in Solving Problems According to the Information Processing Model			
	A. Understanding the problem (i.e., developing a reasonable representation).		___/3	___/3
	C. Effective problem solving is related to abstract knowledge structures.		___/3	___/3
	VII. Discussion of the intractibility of general methods and domain specific methods of problem solving		___/2	___/3
			TOTAL SCORES: ___/41	___/45

Appendix D: Example of Note Quality Task and Scoring

Rater: <u>1</u>	OUTLINE	Protocol <u>111</u>	Notes	Essay
I. Functions of Problem Solving in Education				
A. Problem solving is a <u>cognitive activity</u> that is important to <u>educational theory</u> and <u>classroom practice</u> .			<u>0</u> / 3	<u>0</u> / 3
B. Problem solving is considered part of learning <u>subject matter</u> . It serves a <u>testing</u> and <u>teaching</u> function.			<u>2</u> / 3	<u>2</u> / 3
II. Definition of a Problem According to Information Processing Theory				
A. "1) A problem is said to exist when an individual has a particular goal but is unable to obtain that goal. 2) It is frequently assumed that there is some type of obstacle or barrier that prevents the solver from reaching the goal. 3) These obstacles must, of necessity, be broadly defined and include such factors as failure to remember and lack of information." (<i>lack of skill and knowledge also acceptable</i>)			<u>2</u> / 3	<u>1</u> / 3
III. Information Processing Approach				
A. Information Processing Concepts				
1. Problem Representation			<u>1</u> / 3	<u>0</u> / 3
2. Goal States			<u>1</u> / 3	<u>0</u> / 3
3. Constraints			<u>2</u> / 3	<u>0</u> / 3
4. Problem States			<u>2</u> / 3	<u>0</u> / 3
5. Operators			<u>0</u> / 3	<u>0</u> / 3
6. Ill-Structured Problems			<u>1</u> / 3	<u>0</u> / 3
B. Tower of Hanoi problem			<u>0</u> / 2	<u>0</u> / 3
IV. Research Findings: Problem Solving in Particular Domains				
A. "Chess" studies			<u>3</u> / 2	<u>2</u> / 3
B. "Physics" studies			<u>3</u> / 2	<u>2</u> / 3
V. Factors Involved in Solving Problems According to the Information Processing Model				
A. Understanding the problem (i.e., developing a reasonable representation).			<u>0</u> / 3	<u>0</u> / 3
C. Effective problem solving is related to abstract knowledge structures.			<u>1</u> / 3	<u>0</u> / 3
VII. Discussion of the intractability of general methods and domain specific methods of problem solving			<u>2</u> / 2	<u>0</u> / 3
TOTAL SCORES:			<u>20</u> / 41	<u>7</u> / 45

VI

3

Please read the following silently as I read it aloud. You are going to watch the videotape of a 20 minute lecture about the psychology of problem solving. Use this sheet of paper and the next to take your lecture notes. Remember, the notes you take will be used to study for the exam question. When the lecture is done, take a moment to complete your notes, turn the page and wait for instructions for the next task. Do not tear these pages out of the packet. If there are no further questions, I will begin the 20 minute lecture.

Problem Solving

Serves 2 functions

- ① Testing - has / has not learned
- ② Teaching

Discussion of problem solving

P.s research

Summary of recent work on recent

PS: Individual has a goal but cannot obtain it - possibly due to barrier (lack of knowledge)

Info: Process - acquire, store, retrieve info

Initial State / Goal state

problem representation

Problem States: all possibilities

Research findings

Process - initial state to goal state

* Chess challenges problem Solving

Initial - assume it's high

Goal - how we reduce it

Problem - funding constraints - poverty

ill structured • well structured

Notes

Chess

- Practice & experience are imp. to move selection
- high skill could remember more

Physics

- expert knowledge is more abstract
- problem representations imp. for P.S

knowledge of experts & novices are organized differently, experts have sets of equations together

novices may identify a variable for solution and then choose when novice is familiar w/ a problem

In chess & physics developing abstract structures is crucial to problem solving

- NO particular set of skills is relevant in all P.S
- equipping students w/ P.S skills is imp & helps them
 - little evidence shows success in classes of P.S @ universities
 - Students teaching help them understand better

When the lecture is done, take a moment to complete your notes, turn the page and wait for instructions for the next task.

Please read the following silently as I read it aloud. Based on the videotaped lecture you saw, write an organized summary about the psychology of problem solving. Your summary should not extend past the front and back of the next sheet of paper. You can use this sheet of paper to organize your thoughts, if you wish. You may not refer back to your notes. Write as legibly as you can. You will have 15 minutes to write your summary. Are there any questions? Turn the page and begin.

Problem solving is something that everyone deals with. It deals w/ teaching & testing. This allows the teacher to evaluate the skills & understanding of a student.

People w/ expert skill in an area see things more abstractly & when problem solving tends to group things together. On the other hand people w/ novice skill will look for a variable & then look for a solution.

These points can be seen when people are playing chess & doing physics problems.

Problem solving, specifically, is when a person has difficulty reaching a solution usually due to some kind of barrier.