To the Graduate Council:

I am submitting herewith a dissertation written by Alan Eggert entitled "An Investigation of Notetaking as a Predictor of Course Performance and Course Evaluation." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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We have read this dissertation
And recommend its acceptance:

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Interim Vice Provost and
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AN INVESTIGATION OF NOTETAKING AS A PREDICTOR OF COURSE PERFORMANCE AND COURSE EVALUATION

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Alan Christopher Eggert
August 2001

ACKNOWLEDGEMENTS

I wish to express my appreciation to those individuals who assisted me in this dissertation. The following people were of special help, and I would like to acknowledge my debt to them:

I thank Dr. Robert Williams, who developed the topic and guided my work with patience, understanding, and expertise. I thank the other members of my committee—Dr. Lane Morris, Dr. Gary Klukkan, and Dr. Katherine Greenberg—for their helpful suggestions and assistance.

I thank Ms. Eden Abramson and Ms. Monica Wallace for helping score student notebooks to attain interrater reliability for this project.

I thank Ms. Becky Bledsoe, Department Secretary for Educational Psychology, for her thoughtfulness and kindness.

I thank The University of Tennessee and the Educational Psychology Department for providing me with a graduate assistantship. This financial contribution made it possible for me to pursue my doctorate degree in school psychology.

Lastly, the greatest debt is owed to my family and friends, especially my wife DeeDee. Without their help, support, and encouragement, I wouldn't be where I am today.

ABSTRACT

The purpose of the study was to determine the relationship between different facets of notetaking and academic performance (essay quizzes, multiple-choice exams, term project, and final grade) in a full-semester course with a strong content base. A total of 129 students in 2 sections of an undergraduate human development course submitted their study guides (which contained all of their class notes) for research analysis at the end of the semester. Three dimensions of notetaking (completeness, length, and accuracy) were assessed in 2 domains (reading materials and class discussion).

The study found that the 3 dimensions yielded similar correlations with performance measures. However, with the exception of essay quizzes (which were based exclusively on the reading materials), notetaking over class discussion was more highly related to the performance variables than was notetaking over the reading materials. Accuracy of notes over class discussion was an especially good predictor of most performance variables. Females proved to be better notetakers than males, but the different academic levels did not differ in their notetaking proficiency. No notetaking variable was strongly related to student

satisfaction with the course, as reported on class evaluations at the end of the semester.

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Chapter I

Literature Review on Notetaking in College Courses

Notetaking is a generalized practice among college students whenever professors present content-related information. Palmatier and Bennett (1974) reported that 99% of college students interviewed indicated that they took notes while listening to professors' lectures. Some students try to record everything said by the lecturer, usually devising a shorthand method; other students pick and choose parts of the lecture that they deem important; and still others (or perhaps all) spend time doodling or drawing as they listen (Hartley & Marshall, 1974).

The importance of student notetaking is underscored by the emphasis on lecturing in college teaching. The Educational Testing Service (1979) and Blackburn, Pellino, Boberg, and O'Connell (1980) both indicated that more than 70% of professors from a national sample reported that their principal teaching method was lecturing.

Notetaking, by definition, can be described as a process in which instructional stimuli are converted and recoded in mental units that allow the stimuli to be more easily recalled than if the learner did not participate in notetaking (Weener, 1974). Suritsky and Hughes (1991)

proposed that notetaking involves four broad skills: listening, cognitive processing, recording lecture content in written form, and reviewing noted information. Notes may symbolize associational transformations (i.e., verbatim copying), conceptual transformations (i.e., chunking, coding, or organizing the material), or inferential transformations (i.e., discerning rules and inferences). Notetaking gives the learner the opportunity to reorganize, further develop, and incorporate personal interpretations of new material into one's cognitive structure. The process of notetaking allows students to become actively engaged in learning. Based on general principles of learning theory (i.e., active learners learn more than passive learners do), one would assume that notetaking promotes learning (Weener, 1974).

Despite a substantial amount of research on the nature and efficacy of notetaking options in college courses, most of the research has been done under quasi-laboratory conditions. The typical research framework is to have students listen to a recorded lecture under a variety of notetaking conditions. Student's recall of lecture content is then assessed via one or more assessment procedures (e.g., free recall, essay-type test, multiple-choice test)

administered shortly after the lecture, on a delayed basis, or both. Seldom is the nature and efficacy of notetaking options assessed over the duration of a full-semester course.

Also neglected in the notetaking research is the comparative importance of taking notes over reading materials versus taking notes over class presentations. In addressing these gaps in the literature, the current study assessed the importance of three major dimensions of notetaking (completeness, amount, and accuracy) in two domains (reading material and class presentations) over a full-semester course taken by most students in the teacher preparation program at The University of Tennessee.

Predictive Value of Notetaking

C. C. Crawford (1925) is considered to be the pioneering researcher on the effects of notetaking. His research consisted of correlating notetaking and achievement measures in college courses. Two hundred eleven students (ranging from freshmen to graduates) from seven different classes at two different universities participated in Crawford's study. Each class group listened to lectures (from psychology and general field of education) and recorded notes according to their typical

notetaking habits. Quizzes covering the lecture material were then given to each class. The intervals between lecture and quiz varied from two to thirty-five days.

Classes I-V were given traditional essay quizzes (i.e., the students were asked to recall information from the lectures). The quiz for class VI was in the form of a completion test; each main point of the lecture had one statement. Class VII was given a quiz that consisted of thought questions that pertained to the lecture material. Classes I-VI were given prior notice of the quiz, whereas class VII took a pop quiz.

The notes and quizzes were scored according to the number of ideas included from the lecture and then compared to one another. Crawford's results (1925) indicated a significant positive correlation between the number of ideas recorded in personal notes and the number recalled on a quiz. The positive correlations between total points that were correct in both the notes and the quizzes ranged from .36 to .66, with a median of .50 across all seven classes.

A more recent study, conducted by Fisher and Harris (1973), also found the correlation (.44) between the amount of notes taken and performance to be significant. Kiewra (1984b) reported that the number of ideas recorded from

lectures was substantially correlated with performance on tests over those lectures (rs ranging from .54 to .86). Kiewra claimed that the probability of recalling noted information was more than twice the probability of recalling unnoted information. Research conducted by DiVesta and Gray (1972) also supported the assumption that students' ability to recall information verbally presented to them was assisted by taking notes.

Even though most students take notes, the majority of students fail to record a significant amount of important information from professors' lectures. Locke (1977) reported that A students in his sample recorded only 62% of critical lecture ideas. Hartley and Marshall's (1974) sample of college freshmen only noted 11% of critical lecture material, whereas Hartley and Cameron's (1967) sample of third-year students noted only 24% of critical material. Kiewra, Benton, and Lewis (1987) reported that only 37% of points provided in a lecture were recorded by students in general. Other research indicates that students usually note about 50% of lecture points (Hartley & Marshall, 1974; Kiewra, 1985d; Kiewra & Benton, 1987; O'Donnell & Dansereau, 1993).

Looking closer at some of the research concerning the number of critical ideas that students record from the lecture, Kiewra et al. (1987) indicated that the percentage of critical points noted varies with the level of specificity of the points. Kiewra et al. categorized the critical points presented in a lecture as level 1, 2, 3, or 4. Level-1 ideas were considered to be main points, whereas levels 2 through 4 ideas were increasingly subordinate points of the lecture. Kiewra et al. found that students in general recorded 91% of the main ideas (level 1) from the lecture, but decreasing percentages (60, 35, and 11) of subordinate ideas (level 2, 3, and 4, respectively) were noted.

The records of main ideas were found to have no predictive value for short-term or long-term test performance (most likely because 91% of the main points were recorded by the students); however, the records of the secondary points (levels 2 and 3 only) did have predictive value. The predictive value of the subordinate ideas increased as performance assessment was delayed (i.e., correlations between noted subordinate ideas and test scores were higher when the tests were given several weeks after the lecture as opposed to only one week after the

lecture). The amount of level-4 ideas recorded was found to be unrelated to lecture-specific performance but was predictive of performance on tests given several weeks after the lecture.

Additional studies by Kiewra et al. (1991), Laidlaw, Skok, and McLaughlin (1993), and Klemm (1976) concluded that providing students with skeletal outlines of the lecture material increased the number of critical points noted by students. The skeletal outline provided space for students to note information under headings and topics (from main ideas to less subordinate ideas) that the lecturer deemed important. Results from these studies also indicated that students provided with a skeletal outline of the lecture material had higher achievement than those not provided with an outline.

Taking Versus Reviewing Notes

In searching for the connection between notetaking and academic achievement, both DiVesta and Gray (1973) and Suritsky and Hughes (1991) concluded that both the process and the product of notetaking are related to academic achievement. However, mixed results have been found in determining which aspect of notetaking is more important. The process of taking notes, independent of review,

increases students' attention during a lecture and allows lecture ideas to be encoded into long-term memory. Allowing the information to be encoded in long-term memory aids in recall. The encoding process also permits the student to note subjective associations, inferences, and personal interpretations of the lecture material (DiVesta & Gray, 1972).

Hartley (1983) and Kiewra (1985b) both reviewed experimental research that compared the achievement of students who took notes with that of students who listened to the lecture but did not engage in notetaking. A total of 61 studies were reviewed; 35 of them endorsed the process of notetaking, thus supporting the notion that the students who took notes had greater achievement than students who did not record notes. Of the remaining 26 studies, 23 found no significant difference in performance between students who did or did not take notes, and only 3 studies reported notetaking as being less effective than just listening. One study that did not support the association between encoding and academic achievement was conducted by Kiewra (1985a). He concluded that "simply recording notes is not an effective activity unless those notes are reviewed" (p. 396).

The product function of notetaking refers to the hard copy of critical ideas from the lecture that can be reviewed before a test. Several studies, including those by Crawford (1925), Fisher and Harris (1973), Kiewra (1984b), Kiewra and Benton (1985), Kiewra et al. (1987), and Locke (1977), all found significant correlations between the amount of notetaking and achievement when the students reviewed notes. Hartley (1983) and Kiewra (1985b) both reported that 75% (24 out of 32) of the experimental studies they reviewed indicated that notetakers who reviewed their notes perform better than notetakers who did not review their notes. Most of the research on reviewing focused on the nature of the notes reviewed rather than the timing and logistics of the reviewing process (Armbruster, 2000).

Kiewra's own research (1985a) again found differing results. One conclusion indicated that students who reviewed personal notes scored significantly higher on factual items than did students who took notes but studied without them. However, with regard to higher order learning, no differential effects on average performance were produced by reviewing (Kiewra, 1985a). Thus, reviewing notes may help one to remember the specifics of factual

information rather than understand the general principles embedded within that information.

Another study conducted by Kiewra (1985c) found that the act of reviewing notes is more important than the process of taking notes. However, the advantages of reviewing notes are decreased when notes lack accuracy, completeness, and organization. Kiewra further indicated that students who reviewed a complete set of notes provided by the instructor achieved significantly higher scores on factual items than did students who reviewed personal notes or reviewed mentally. In explaining his results, Kiewra (1985c) pointed out that the "students who took and reviewed their own notes recorded only 35 critical lecture points and, therefore, had available only 30 percent of ideas that were in the instructors notes" (p. 76). The notes that were provided by the instructor were well organized, accurate, and contained 100% of the critical lecture points (Kiewra, 1985c). The findings of this study parallel the results of Collingwood and Hughes (1978).

Annis (1981) investigated the effect that three notetaking and reviewing conditions had on student performance on multiple-choice and essay-type tests over a specific lecture. The three different notetaking conditions

were (a) personal notes—students took their own notes from lecture, (b) partial notes—students were given outline of lecture with space available to take their own notes under specific headings, (c) instructors' notes—students were provided with a complete set of notes and instructed not to take personal notes. Students in all three notetaking groups had equal time (2 weeks) to review their notes prior to taking an exam on the lecture material.

The results of Annis's study indicated that students provided with a partial set of notes achieved significantly higher scores on multiple-choice tests than the students in the other two notetaking groups. The mean scores were 5.30 for students provided with instructors' notes, 5.43 for students who took personal notes, and 6.87 for students provided with a partial set of notes F (2, 98) = 6.65, p < .01. On the essay-type test, students who constructed their own notes scored significantly higher than students provided with either partial or a complete set of notes. The mean scores were 1.97 for students provided with a complete set of instructor notes, 3.97 for students with partial notes, and 5.54 for personal notetakers F (2, 98) = 18.18, p < .0001. In both testing situations, students who actively participated in taking notes (both personal- and

partial-note conditions) had higher achievement than students provided with instructor notes.

A possible explanation of Annis's results is that different testing methods require different processes of retrieving learned information. Multiple-choice tests require the student to recognize information, whereas essay-type tests require students to recall information. Providing students with headings and key points of the lecture with space to add personal notes appears to be the most efficient method of notetaking for recognition of information. On the other hand, personal notetaking may be a more effective method of notetaking for recalling information.

Irrespective of the notetaking procedure or the nature of notes, how one reviews the existing notes can make a difference in performance. Often students approach reviewing in a relatively passive way, reading through their notes and trying to remember lecture comments. King (1992) proposed a more active strategy for reviewing, using a procedure called self-questioning. Students are taught through direct instruction to ask higher order comprehension questions about their notes. A combination of individual and group self-questioning of this nature has

been particularly effective in promoting performance on delayed recall tests.

A corollary reviewing strategy, summarizing in writing the main and connected ideas in a lecture, promoted immediate recall of lecture ideas (King, 1992). However, Kiewra, Benton, Kim, Risch, and Christensen (1995) found that constructing a comparative essay about lecture points was primarily effective after student use of an outline framework for notetaking. Otherwise, students who prepared such essays performed worse on a later conceptual task than students who reviewed their notes in a conventional manner.

Relationship of Notetaking to Student Characteristics

Gender appears to be the student characteristic most consistently related to the process and effects of notetaking. Kiewra (1984a) found that female students noted more critical points (72% to 63%), test-related points (76% to 68%), and words (354 to 280) than male students did. Also, females significantly outscored males on delayed exams (74% correct to 59% correct) covering the lecture material ($t = 2.41$, $p < .05$). Lacroix (1987) suggested that these results are atypical and that many studies containing notetaking variables found no differences in achievement between men and women. One weakness and possible reason for

the results of Kiewra's study is that his sample consisted of 29 undergraduate students, with 22 females and only 7 males. In a similar, yet more recent and larger study, Cohn, Cohn, and Bradley (1995) discovered that females recorded more words than males on a notetaking task as well as recording more detailed information about the subject matter.

Carrier, Williams, and Dalgaard (1988) used a path model to examine the relationship between several notetaking variables and gender in a macroeconomics course. First, the Notetaking Perceptions Survey (NPS) was used to determine students' notetaking preferences (Carrier & Newell, 1984). This survey consists of 68 items that reflect seven notetaking themes: general instructional preferences, review of notes, assumptions about teaching and learning, attitudes towards exams, perceptions of self-competence, value of notetaking, and typical notetaking behavior.

The results of the study indicated that females valued notetaking more than males (beta = .41, t = 5.21, p < .001), displayed higher competence in notetaking skills (beta = -.19, t = -2.33, p = .02), and performed better on notetaking activities (beta = .17, t = 2.07, p < .04)

(Carrier et al., 1988). In a more recent study, Cohn et al. (1995) discovered that females recorded an average of 40 more words than their male counterparts on a notetaking task, and females also recorded more detailed information about subject matter ($F = 8.70$, $p < .01$).

Gender is not the only personal variable related to notetaking skills. Cohn et al. (1995) reported that lower level college students performed significantly worse in notetaking than upper level college students did. Likewise, Nye (1978) detected that more notes were recorded by experienced male students than less experienced ones. Additionally, Carrier et al. (1988) reported higher levels of confidence regarding notetaking ability (beta = .18, $t = 2.28$, $p = .02$) for advanced than first-year students.

As previously noted, studies conducted by Hartley and Marshall (1974) and Hartley and Cameron (1967), respectively, found that college freshman noted only 11% of critical lecture points whereas third-year students recorded 24% of main ideas. Palmatier and Bennett (1974) reported that only 17% of college students in their sample had received formal instruction on how to take notes. Their study suggests that notetaking is a learned skill, which is

one possible explanation why advanced students are better notetakers than first-year students.

Individual cognitive variables also affect the accuracy and quality of notes. Kiewra and Benton (1988) concluded that "the effective notetaker uses working-memory capacity to attend, store, and manipulate information selected from the lecture simultaneously, while also transcribing ideas just previously presented and processed" (p. 35). Notetaking facilitated learning in students demonstrating a greater working-memory capacity, whereas learning was inhibited in notetakers with less working-memory capacity (Berliner 1969, 1971; DiVesta & Gray, 1973).

Strategies for Improving the Efficacy of Notetaking

Though considerable research documents the efficacy of notetaking, under some circumstances notetaking may undermine rather than promote learning. The act of writing notes may interfere with the reception of information being presented. Critical information may be missed or misinterpreted while students record previously mentioned points (DiVesta & Gray, 1973; Peters, 1972). However, Eisner and Rohde (1959) did not find notetaking to

interfere with hearing the lecture or processing its content.

Further support for the notion that notetaking may interfere with student listening has been provided by Aiken, Thomas, and Shennum (1975). These researchers compared students' recall under (a) two speaking rates, (b) two information density rates, and (c) three notetaking situations. The two speaking rates were 120 words a minute and 240 words a minute. The two information density rates were 206 information units and 106 information units. The three notetaking situations were "parallel notetaking"—subjects were told to take notes while they listened to the lecture, "spaced notetaking"—subjects were told to listen attentively to lecture and take notes during deliberate pauses in the lecture, and "no notes"—subjects were instructed to listen attentively and not record notes.

The findings of the Aiken et al. (1975) study indicated that students had greater recall when notetaking was separated from listening to the lecture. Additionally, the study indicated that the speed of the presentation and the amount of information contained in the lecture affected recall. Both high information density and accelerated speech hindered recall. Notetaking was not significantly

affected by either speed of presentation or information density. Ruhl and Suritsky (1995) reported that the pausing procedure was especially effective in helping students with learning disabilities to take more complete notes and immediately recall information in their notes.

Hartley and Cameron (1967) and Hartley and Marshall (1974) suggested three strategies to improve students' notetaking and overall attainment of lecture material. The first is for universities to provide guidance in study skills, especially notetaking skills. Second, lecturing needs to be refined to make the notetaking process easier, adjusting such dimensions as pace of delivery, clarity of voice, and use of visual aids. Suritsky and Hughes (1991) found that writing information on a chalkboard substantially increased the likelihood of its being noted and recalled. Presenting material at slower rates and speaking clearly and articulately allows students a better opportunity to process and record all of the information presented. Visual stimuli enhance notetaking by allowing students to process presented material using multiple sensory mechanisms. Lastly, handouts need to be provided for new terms, detailed tables and figures, and references. Providing a clear outline of the content of the lecture

with space available for personal notes also facilitates the precision of notetaking.

Reading material, like lecturing, is also a major source of learning for students (Bretzing & Kulhavy, 1979); however, little research has focused on taking notes from reading passages. Johnson (1973) indicated that relating passage content to previously attained knowledge is essential for efficient recall. For meaningful learning to occur, Bransford and Johnson (1972) concluded that a context (through imagery) must be established in memory. Anderson (1972) refers to this process as semantic encoding. Craik and Lockhart (1972) explained how meaningful encoding of written prose occurs within their depth of processing model. "As people attend to, and analyze a passage more thoroughly, they relate the text to prior knowledge and encode the material semantically. The greater the depth at which the material is processed, the longer the memory trace" (p. 679).

Bretzing and Kulhavy (1979) examined the relationship between depth of processing (how material is encoded) and depth of analysis (how deeply material is being processed). Four notetaking conditions were used to control for depth of processing: (a) letter-search—students recorded all

words in prose in capital letters, (b) verbatim—students recorded portions of the prose word-for-word that were considered to be critical points, (c) paraphrase—students recorded main ideas from each page, in their own words, as it was being read, and (d) summary—students recorded main ideas from each page, in their own words, after it was read. As expected, students who took notes and put the information into their own words, by paraphrasing or summarizing, recalled significantly more ideas than students who used letter-search notes or copied the text verbatim. This study concluded that it is beneficial to incorporate semantic notetaking strategies to increase learning on reading material.

Relationship of Notetaking to Course Evaluation

Little, if any, research has investigated the relationship between student notes and perceived satisfaction with course content and structure. It may be that course evaluations are affected by the amount of time and effort that students invest in a course. Notetaking provides tangible evidence of student investment in the course experience. Thus, students who put forth greater effort and develop more extensive and accurate notes are likely to be more satisfied with the course and prone to

give higher course evaluation ratings than students who exert less effort and produce notes that are less complete and less accurate.

Purpose for the Study

The literature investigating lecture notetaking has been quite extensive and consistent, but little of that research has addressed the nature and efficacy of notetaking over a full-semester course. Available research has generally yielded a positive correlation between notetaking and academic performance. In a study closely related to the current one, Worth (2000) found that notetaking variables were more predictive of overall course performance than were either class attendance or critical-thinking skills. Bivariate correlations produced moderate relationships between attendance and quiz scores, exam scores, and total course score; however, the relationships weakened significantly when total notetaking was controlled for in partial correlations. Regression analysis further indicated that the predictive potential of attendance was largely embedded within the predictive power of total notetaking.

Notetaking research has also underscored relationships between notetaking and selected student characteristics.

For example, females tend to be better notetakers from lecture material than their male counterparts. Also, students at more advanced academic levels record a higher percentage of critical points than do less advanced students.

Research exploring notetaking on reading material has been limited. Few studies have been conducted on the predictive value of reading notetaking (Bretzing & Kulhavy, 1979; Worth, 2000), and some of those studies have sampled high school populations (Craik & Lockhart, 1972). Worth's (2000) study at the college level concluded that reading notetaking was the best predictor of performance for males and that total notetaking (combination of reading and class notetaking) was the best predictor for female performance.

Despite the illuminating findings from Worth's (2000) study, procedural limitations temper the strength of his conclusions. One weakness in Worth's procedure was how the length of student notes was calculated. Raters estimated the length of students' notes rather than counting words. Thus, Worth's method of evaluating the length of students' notes may have yielded imprecise conclusions. Another weakness in the study was the failure to quantify accuracy of notes as a whole. Only limited parts of the notes were

rated for accuracy. Worth developed a formula (using three notetaking variables) to calculate total notetaking scores for each individual student. His formula did not differentiate the relative value of completeness of notes, length of notes, and accuracy of notes in predicting course performance.

The general purpose of the current study was to investigate the status of notetaking in a highly structured undergraduate human development course. Specifically, the study addressed the following questions: What is the relationship between the completeness of student notes, the length of student notes, and the accuracy of student notes? Do these notetaking dimensions differentially predict course performance? Do reading notetaking and lecture notetaking differentially predict course performance? Does the predictive potential of notetaking variables differ by gender and education level? What notetaking variables differentially predict student satisfaction with the course experience?

Chapter II

Method

Participants

Participants were students enrolled in course 210 offered by the Psychoeducational Studies Unit (PES) at The University of Tennessee, Knoxville, during the Fall 1999 semester. PES 210 is the university's gateway course for teacher education. The course emphasized developmental issues that are important to educators. The course was formatted around five developmental units: physical, cognitive, psychological, social, and character. Six multiple-choice exams (five unit exams and a comprehensive final), five brief essay exams over assigned readings, and one major research project assessed student achievement in the course.

A total of 150 students enrolled in the course during the Fall semester of 1999. Two sections of the course were offered, with class capacities of 80 students. The first section of the course was taught by a male professor, whereas the second section of the course was taught by three second-year female graduate assistants. The graduate assistants were required to observe the professor instruct the first section of the course and teach the second

section of the course in the same manner. Both sections of the course used the same format for presenting course materials.

Of the 150 students, only 129 elected to submit their notes for research analysis at the end of the course. A check of performance measures for those that did and did not submit their notes for analysis revealed no significant difference on any performance measure. Students ranged from sophomore through graduate students, with the majority of students being sophomores and juniors (close to 75% of the sample). More females (n = 101) than males (n = 28) participated in the study. Grade distribution for the course was similar to the bell curve. In both sections combined, 17.3% of the students earned a grade of A, 7.3% earned the grade of B+, 30.7% earned a grade of B, 8.7% earned the grade of C+, 22.7% earned the grade of C, 8.0% earned the grade of D, and 5.3% earned the grade of F. This grade distribution is typical for this course.

Participation in this study was voluntary; however, eight percent of course credit was given to students who agreed to participate in all aspects of 210 research. Notetaking was optional; students did not receive course credit for taking notes. Additional research projects were

being conducted concurrently with this study. Other course-credit options were provided for those who declined to participate in these research projects. One hundred percent of the students elected to participate in one or more research projects.

Description of Dependent Variables

Four principal dependent variables were examined in this study: total course score, total multiple-choice exam score, total essay quiz score, and total course evaluation. Measurement of the variables were conducted as follows:

1. Total course score was the sum of scores on multiple-choice exams, brief essay quizzes, course project, and bonus points (possible range 0 to 380).
2. Total exam score was calculated by adding points earned on five unit exams and the comprehensive final exam (possible range 0 to 275).
3. Total essay quiz score was computed by adding points earned on five short essay quizzes over assigned readings in each unit (possible range 0 to 25).
4. Total course evaluation was compiled by adding 0 through 3 ratings on 9 dimensions of the course, ranging from general content to course exams. The course evaluations were done after students had completed all course

requirements and computed their grade in the course (possible range 0 to 27).

Description of Independent Variables

The independent variables included two domains of notetaking (reading and in-class notetaking) and three dimensions of notetaking (completeness of student notes, the length of student notes, and the accuracy of student notes). All student notes were recorded in a study questions guide, which provided questions on the class material and enough space for students to write in information pertaining to each topic discussed in class or assigned for reading. Course material discussed in class was presented in a lecture format in which the course instructor interspersed questions between discussion of small amounts of information. For convenience, the questions in the student's study questions guide were arranged in the exact order that the instructor was lecturing. The notebook was separated into instructor's overview (class lecture), readings, and videotape sections. In total there were 249 study questions in the instructor's overview section, 55 study questions in the videotape section, and 424 study questions in the readings section. Instructor overview and videotape notetaking were combined

to yield an in-class notetaking assessment. The definitions of the dimensions of notetaking were couched in terms of student notes recorded in the study questions guide.

1. Completeness of students' notes was defined as the number of questions attempted to be answered in the student study questions guide. To generate a completeness of student notes score, the total number of study questions that were attempted to be answered in the student study questions guide was recorded (possible range 0 to 728).

2. The length of students' notes was defined as how many words the students used to answer each of the study questions. A random sample consisting of 20 percent of the study questions in each section of the study guide for each unit of the course was selected to determine the length of students' notes. A random distribution table was used to select questions to be evaluated. The randomly chosen study questions for each unit were the same for each notebook examined. Any selected questions that were not attempted received a score of zero. To determine each student's length of notes score, raters totaled the number of words from the randomly selected study questions.

3. The accuracy of students' notes refers to the extent that the students' notes match the notes of the

professor of PES 210. The professor's notes are those used to instruct the class. A random sample consisting of 20 percent of the study questions in each section of the study guide for each unit of the course was selected to determine the accuracy of students' notes. Again, a random distribution table was used to randomly select questions, which resulted in a different set of questions from those used in the analysis of the length of notes. The randomly chosen study questions for each unit was the same for each notebook examined. Each study question evaluated was rated on a score from 0 through 5 (a score of 0 indicating no consistency between the student response and the professor response and a score of 5 indicating total consistency between the two responses). Any selected questions that were not attempted received a score of zero. The study question scores were then tallied for each individual, thus yielding an accuracy of notes score.

A total of three graduate students rated student notebooks for accuracy of notes. One rater evaluated all of the notebooks, and the other two raters each reassessed 20 notebooks previously evaluated by the first rater. Correlation matrices were used to determine the interrater

reliability within the study. Table 1 shows that overall degree of agreement among raters was quite high.

The range of correlation between Rater 1 and Rater 2 was .801 (instructor overview notes for Unit A) to .992 (reading notes for Unit C), with a correlation of .948 across the entire set of notes. It appears that the correlations between Rater 1 and Rater 2 were progressively better with each developmental unit in the course (.917 for Unit A and .974 for Unit E). Correlations between Rater 1 and Rater 2 were best across reading notes (.990) and worst across instructor overview notes (.920).

The range of correlation between Rater 1 and Rater 3 was .926 (video notes for Unit A) to .994 (instructor overview notes for Unit E), with a correlation of .969 across the entire set of notes. There appears to be no specific pattern to the correlations between Rater 1 and Rater 3; however, correlations for developmental units D and E were highest (.978 for Unit D and .981 for Unit E). Correlations between Rater 1 and Rater 3 were best across instructor overview notes (.981) and worst across video notes (.957).

Table 1

Interrater Reliability Correlations

Raters	Unit	Notetaking domains			
		Reading notes	Video notes	I.O. notes[a]	Total notes
Rater #1 versus Rater #2					
	Unit A	.990*	.961*	.801*	.917*
	Unit B	.990*	.885*	.899*	.925*
	Unit C	.992*	.915*	.983*	.963*
	Unit D	.987*	.934*	.962*	.961*
	Unit E	.992*	.976*	.955*	.974*
	Total	.990*	.934*	.920*	.948*
Rater #1 versus Rater #3					
	Unit A	.949*	.926*	.958*	.944*
	Unit B	.980*	.972*	.977*	.976*
	Unit C	.965*	.941*	.981*	.962*
	Unit D	.971*	.974*	.990*	.978*
	Unit E	.970*	.980*	.994*	.981*
	Total	.967*	.957*	.981*	.969*

[a]Instructor overview notes.

*Correlation is significant at the .01 level (2-tailed).

Chapter III

Results

The findings are presented in four sections: relationships among the notetaking dimensions for the total sample, relationships between the notetaking variables and performance measures for the total sample, demographic differences in the nature and predictive potential of notetaking, and relationship between notetaking and course evaluation. Findings are expressed in terms of correlations, multiple-regression analyses, and multivariate analysis between groups.

Relationships Among the Notetaking Dimensions for the Total Sample

With the distinctions between notetaking over readings and notetaking over class discussion preserved, the completeness, length, and accuracy scores were correlated with one another for the total sample. A total notetaking score computed by adding all of the specific notetaking scores was added to the correlation matrix. Several patterns seem apparent from the results reported in Table 2: (a) Readings notetaking measures were more highly correlated with total notetaking than were the class discussion notetaking measures; (b) correlations were

Table 2

Correlation Matrix for Notetaking Dimensions

Notetaking variable	Com CL	Len R	Len CL	Acc R	Acc CL	Tot note
Com R	.571*	.863*	.576*	.983*	.779*	.878*
Com CL		.517*	.706*	.571*	.858*	.674*
Len R			.673*	.912*	.736*	.957*
Len CL				.615*	.793*	.841*
Acc R					.799*	.917*
Acc CL						.860*

Note. Com R represents completeness of readings notes; Com CL represents completeness of class notes; Len R represents length of readings notes; Len CL represents length of class notes; Acc R represents accuracy of readings notes; Acc CL represents accuracy of class notes; and Tot note represents the total of the specific notetaking variables.

*Correlation is significant at the .01 level (2-tailed).

stronger within domains (i.e., readings or class discussions) than within dimensions (i.e., completeness, length, and accuracy); (c) most of the correlations between domains and dimensions of notetaking were in the moderate to high range.

A stepwise multiple regression using the domain-dimension combinations as predictors and the total notetaking score as the criterion score evaluated the predictive potential of each notetaking variable. Because some of the notetaking scores yielded much larger numbers than others, all notetaking variables were converted to z-scores for the regression analysis. The one strongest predictor of the total notetaking scores was the length of readings notetaking, accounting for approximately 92% of the variance in total notetaking. Length of class notetaking accounted for another 7% of the variance. Thus, in terms of accounting for total notetaking, length of responses (especially for readings) maximized predictability of total notetaking.

Relationships Between Notetaking Variables and Performance Measures for the Total Sample

These relationships are presented in sequence for quizzes, exams, projects, and total course grades. The

correlation matrices show an overall pattern of relationships between notetaking and performance variables, whereas the regression analyses pinpoint the most powerful notetaking predictors for each performance variable.

Quiz Scores. Table 3 shows the pattern of correlations between the notetaking variables and essay quizzes across units for the total sample. Because the quiz questions were always taken from study questions over reading materials, one would expect the readings notetaking measures to be more highly correlated with quiz scores than were class discussions notetaking measures. Table 3 generally confirms this expectation. This pattern was very consistent for the correlations between notetaking variables and total quiz scores, but not entirely consistent across units in the course. A departure from the expected pattern was most apparent for Unit E (Character Development), which contained many abstract issues addressed in class discussions. Overall, the notetaking dimensions (i.e., completeness, length, and accuracy) across domains were similarly correlated with quiz scores.

A stepwise regression analysis using the notetaking combinations as predictor variables and quiz scores as the criterion variable showed that accuracy of reading scores

Table 3

Correlations Between Notetaking and Essay Quizzes Across Units

Notetaking variable	Total	Unit A	Unit B	Unit C	Unit D	Unit E
Com R	.518**	.441**	.190*	.396**	.241**	.296**
Com CL	.419**	.092	.178*	.284**	.039	.405**
Len R	.507**	.343**	.299**	.334**	.285**	.327**
Len CL	.483**	.209*	.262**	.444**	.181*	.405**
Acc R	.526**	.446**	.237**	.386**	.278**	.278**
Acc CL	.480**	.145	.246**	.405**	.044	.412**

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

accounted for 27% of the variance in total quiz scores (see Table 4). The length of class notes accounted for another 4% of the variance. No other notetaking variable accounted for a significant portion of the variance in quiz scores.

Exam Scores. The correlation pattern that emerged for the quiz scores was reversed for the exam scores (i.e., notetaking over class discussions was a stronger predictor of exam scores than were the reading scores; Table 5). This was true despite the fact that exam items placed equal emphasis on reading and class notes. The stronger relationship between class discussion notes and exam performance was not evidenced in Unit A but became highly apparent for the remaining units. From Unit B on, there was only one exception to the pattern of higher correlations for class discussion notetaking than readings notetaking. The correlations between the various dimensions of notetaking (i.e., completeness, length, and accuracy) and exam scores appeared to be at approximately the same level.

The only notetaking variable that accounted for a significant percentage of the variance in exam scores in the stepwise regression analysis was accuracy of notes over class discussion, accounting for 28% of the variance in exam scores (refer to Table 4). Thus, accurately recording

Table 4

Significant Notetaking Predictors for Performance Variables

Performance variable	Sample	Notetaking predictors	Percentage of explained variance
Quizzes	Total (N = 129)	Acc R	27%
		Len CL	4%
	Males (n = 28)	Len CL	48%
	Females (n = 101)	Com R	23%
		Len CL	3%
Exams	Total	Acc CL	28%
	Males	Len CL	21%
	Females	Acc CL	33%
Projects	Total	Acc CL	16%
	Males	Acc CL	14%
	Females	Com CL	17%

(table continues)

Table 4 Continued.

Performance variable	Sample	Notetaking predictors	Percentage of explained variance
Course grades	Total	Acc CL	36%
		Len CL	2%
	Males	Len CL	34%
	Females	Acc CL	40%

Table 5

Correlations Between Notetaking and Exams Across Units

Notetaking variable	Total	Unit				
		A	B	C	D	E
Com R	.398**	.326**	.366**	.313**	.219*	.404**
Com CL	.501**	.312**	.462**	.298**	.348**	.462**
Len R	.435**	.349**	.404**	.322**	.235**	.385**
Len CL	.510**	.287**	.477**	.400**	.324**	.463**
Acc R	.429**	.354**	.412**	.340**	.246**	.415**
Acc CL	.537**	.301**	.524**	.385**	.417**	.498**

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

what had been presented in class proved pivotal to doing well on the exams.

Course Project. Because no unit scores were available for projects and total grades, the notetaking measures were correlated with only one project score and one total grade. Inasmuch as the course project went well beyond the content of the reading materials and class discussions, one would not expect the notetaking measures to be as highly correlated with the project scores as with the other dependent variables. As expected, the correlations with project scores were lower than for quizzes and exams.

Specifically, the correlations between notetaking variables and project scores were .307 for completeness of notes over readings, .373 for completeness of notes over class discussion, .318 for length of notes over readings, .361 for length of notes over class discussion, .328 for accuracy of notes over readings, and .402 for accuracy of notes over class discussion. These correlations would be considered in the weak to moderate range. Nonetheless, as with the exam correlations, class discussion notetaking measures proved to be more strongly correlated with project scores than did the readings notetaking measures. As with both quizzes and exams, there was minimal difference in the

magnitude of correlations for the notetaking dimensions (i.e., completeness, length, and accuracy).

Similar to the findings for the regression analysis on exam scores, accuracy of class notes emerged as the only significant predictor of project scores (accounting for 16% of the variance). However, this amount of explained variance is approximately half that of the explained variance for exams (see Table 4). Given the small amount of time devoted in class to discussing the project, it is surprising that accuracy of class notes accounted for as much of the variance in project scores as proved to be the case. Maybe students who accurately record instructor explanations in class also are more inclined to closely follow directions regarding other course activities.

Course Grade. Perhaps the most compelling support for the predictive potential of the notetaking variables was their correlations with the total grade in the course. These correlations were .469 for completeness of reading notes, .584 for completeness of class notes, .481 for length of reading notes, .563 for length of class notes, .495 for accuracy of reading notes, and .602 for accuracy of class notes. These correlations are all in the moderate range, but somewhat higher than the correlations between

notetaking and more specific dependent measures. As was the case for both exams and projects, class discussion notetaking variables were more highly correlated with total grades than were readings notetaking variables. Also similar to the correlational patterns for other dependent variables, the different dimensions of notetaking were similarly predictive of total grades.

A stepwise regression analysis for grades provided added support for the predictive potential of accuracy of class notes, which accounted for 36% of the variance in grades (see Table 4). The only other significant predictor was length of class notes, accounting for another 2% of the variance in grades. Except for predicting performance on quizzes, which were based strictly on the reading materials, how accurately students noted what the instructor presented in class had far more predictive potential than any of the notetaking dimensions for reading.

High-Low Comparisons. As a final check on the predictive potential of the various notetaking variables, a median split into high and low groups was first done for each notetaking variable. Then a multivariate comparison of course performance for these groups was done across the

performance variables in the course. This analysis revealed that high and low groups for both accuracy of readings notes and length of class notes obtained significantly different scores across performance variables. Univariate follow-up tests showed that the high and low groups for accuracy of readings notes obtained significantly ($p < .05$) different scores for both quizzes and exams. The high and low groups for length of class notes yielded significant differences for quizzes, exams, and total grades.

Demographic Differences

The two major demographic variables addressed in this analysis were gender and academic level (sophomores through graduate students). Differences in notetaking patterns by gender (Table 6) and academic-level are presented first. Then, gender and academic level comparisons for correlations between notetaking measures and performance measures are presented in subsequent tables. Finally, the best notetaking predictor(s) for each performance dimension was established by gender via regression analysis. The performance measures are considered in the same sequence for the demographic analysis as that for the total sample: quizzes, exams, project, and total course grade.

Table 6

Gender Differences in Notetaking Variables

Notetaking variable	Gender	Mean	SD	N	Significance level
Com R	Males	184.50	162.87	28	.000
	Females	291.67	129.85	101	
	Total	268.41	143.99	129	
Com CL	Males	246.61	66.07	28	.011
	Females	272.68	41.00	101	
	Total	267.02	48.48	129	
Len R	Males	702.29	757.32	28	.003
	Females	1186.86	747.90	101	
	Total	1081.68	773.43	129	
Len CL	Males	1190.93	533.90	28	.032
	Females	1399.97	426.84	101	
	Total	1354.60	458.21	129	

(table continues)

Table 6 Continued.

Notetaking variable	Gender	Mean	SD	N	Significance level
Acc R	Males	154.11	142.74	28	.000
	Females	251.79	121.43	101	
	Total	230.59	132.11	129	
Acc CL	Males	198.39	79.62	28	.000
	Females	252.72	56.80	101	
	Total	240.95	66.06	129	

Gender Comparisons. Table 6 reveals that females scored significantly higher on all notetaking variables than did males. The gender difference was substantial for all notetaking variables but was most pronounced for length of readings notes. With respect to accuracy of notetaking (the most predictive dimension for the total sample), males obtained an item mean of 1.81 (on a scale of 0 to 5) for accuracy of readings notes and an item mean of 3.25 for accuracy of class notes. In contrast, females obtained an item mean of 2.96 for accuracy of readings notes and a 4.14 item mean for accuracy of class notes. Although both males and females obtained higher item ratings on the accuracy of class notes than on the accuracy of readings notes, females were substantially higher than males on both dimensions.

Table 7 shows that the various notetaking variables correlated more highly with quiz scores for males than for females. Thus, for the brief essay quizzes, it appears that notetaking might be more fundamental to males' success than to females'. Most of the correlations for males were in the medium to high range, whereas most of the correlations for females were in the medium range.

The regression analyses showed a somewhat different pattern of prediction of quiz scores for males and females

Table 7

Correlations Between Notetaking and Essay Quizzes Across Gender and Classes

	Gender		Class			
Notetaking variable	Males	Females	Soph	Jun	Sen	Grad
Com R	.593**	.489**	.579**	.439**	.290	.694*
Com CL	.464*	.393**	.510**	.351*	.443*	.349
Len R	.612**	.469**	.553**	.536**	.203	.470
Len CL	.705**	.392**	.572**	.411*	.308	.416
Acc R	.635**	.486**	.591**	.486**	.252	.636
Acc CL	.583**	.436**	.626**	.344*	.397	.560
Tot Note	.678**	.506**	.631**	.527**	.291	.524

Note. Soph = sophomores, Jun = juniors, Sen = seniors, and Grad = graduate students.

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

(refer to Table 4). For males, the length of class notes proved to be the only significant predictor of quiz scores, accounting for about 48% of the variance. For females, completeness of readings notes was the primary predictor, accounting for 23% of the variance in quiz scores. The only other significant predictor of quiz scores for females was length of class notes, accounting for 3% of the variance. The regression analysis by gender presents quite a different picture of prediction of quizzes than that which emerged from the total sample, where the accuracy of readings notes was the most powerful predictor.

In contrast to the pattern for essay quizzes, the correlations between notetaking variables and exam scores were stronger for females than males (see Table 8). Every single correlational comparison favored females over males. Most of the male correlations were in the weak to moderate range, whereas most of the female correlations were in the moderate range.

The gender-related regression analysis for exam scores affirmed the importance of class notetaking, but the primary class notetaking predictor was different for males and females. For males, the only significant predictor was length of class notes, accounting for 21% of the variance

Table 8

Correlations Between Notetaking and Exams Across Gender and Classes

	Gender		Class			
Notetaking variable	Males	Females	Soph	Jun	Sen	Grad
Com R	.297	.432**	.414**	.445**	.151	.161
Com CL	.451*	.522**	.548**	.582**	.255	.401
Len R	.379	.450**	.486**	.442**	.156	.355
Len CL	.495*	.508**	.614**	.337*	.377	.400
Acc R	.337	.461**	.465**	.454**	.209	.237
Acc CL	.454*	.579**	.617**	.550**	.388	.232
Tot Note	.438*	.534**	.578**	.467**	.267	.369

Note. Soph = sophomores, Jun = juniors, Sen = seniors, and Grad = graduate students.

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

in exam scores. For females, the only significant predictor was accuracy of class notes, accounting for 33% of the variance.

Although not as clear cut as the gender comparisons for quizzes and exams, the pattern of correlations between notetaking measures and project scores generally favored males over females (see Table 9). With one exception (completeness of class notes), all of the correlations were higher for males than females. However, most of these correlations were in the weak to moderate range, thus suggesting that notetaking was not strongly related to project scores for either males or females.

The regression analysis by gender showed that accuracy of class notes was the only significant predictor of project scores for males, accounting for 14% of the variance (refer to Table 4). For females, the only significant predictor was completeness of class notes, accounting for 17% of the variance. Although the specific notetaking dimension was different for males and females, recording what was said in class proved to be a significant predictor of project performance for both sexes.

With all credit-producing activities factored into the total course grade, the notetaking variables generally

Table 9

Correlations Between Notetaking and Projects Across Gender and Classes

	Gender		Class			
Notetaking variable	Males	Females	Soph	Jun	Sen	Grad
Com R	.350	.278**	.281*	.298	.561**	.448
Com CL	.275	.419**	.295*	.576**	.643**	.053
Len R	.354	.299**	.281*	.308	.583**	.578
Len CL	.382	.343**	.365**	.362*	.616**	.124
Acc R	.364	.305**	.290*	.325*	.606**	.521
Acc CL	.416*	.393**	.382**	.460**	.615**	.248
Tot Note	.388*	.358**	.344**	.373*	.664**	.427

Note. Soph = sophomores, Jun = juniors, Sen = seniors, and Grad = graduate students.

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

correlated more strongly with grades for females than for males (see Table 10). The one exception to this overall trend was in the length of notes over class discussion, where the correlation was higher for males than females. In the main, the correlations between notetaking and total grade were in the upper medium range for both males and females.

The regression analysis by gender showed that length of class notes was the only significant predictor of course grades for males, accounting for 34% of the variance (refer to Table 4). For female students, accuracy of class notes was the only significant predictor, accounting for 40% of the variance. Thus, recording what the instructor presented in class was a strong predictor of grades for both genders, with the primary emphasis on length of notes for males and accuracy of notes for females.

Academic Classification. Multivariate analysis of variance revealed no significant differences in notetaking variables by academic classification. Even the raw score notetaking means were remarkably similar across academic levels.

With the exception of the correlations between notetaking and project scores, the correlations between

Table 10

Correlations Between Notetaking and Course Grades Across Gender and Classes

	Gender		Class			
Notetaking variable	Males	Females	Soph	Jun	Sen	Grad
Com R	.389*	.501**	.529**	.421**	.261	.168
Com CL	.560**	.600**	.653**	.611**	.375	.447
Len R	.462*	.485**	.538**	.447**	.259	.374
Len CL	.605**	.542**	.672**	.382*	.446*	.463
Acc R	.427*	.523**	.564**	.446**	.319	.244
Acc CL	.560**	.634**	.716**	.555**	.494*	.252
Tot Note	.540**	.581**	.652**	.482**	.372	.403

Note. Soph = sophomores, Jun = juniors, Sen = seniors, and Grad = graduate students.

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

notetaking and performance tended to diminish from the sophomore to the graduate level (see Tables 7 through 10). The one exception to this trend was the seniors' correlations between notetaking and project score, which were all higher than those for any other class (see Table 9). The relatively small n (21) for the seniors makes generalization of this difference tenuous. This superiority was not apparent for any other performance measure.

The examination of correlations between notetaking and quiz scores by class reveals that most correlations were in the weak to moderate range. In most comparisons, the sophomore students produced the highest correlations between notetaking and quiz scores of any class. However, a few of the correlations for graduate students exceeded those for sophomores. It should be noted that the graduate group included only 9 students, severely limiting the generalizability of results from this group. Seniors, who had yielded the highest correlations between notetaking and projects, generally produced the lowest correlations between notetaking and quiz scores.

The regression analyses by class showed that the primary predictor of quiz scores for sophomores was accuracy of class notes, accounting for 38% of the

variance; for juniors the primary predictor was length of readings notes, accounting for 27% of the variance; for seniors the primary predictor was completeness of class notes, accounting for 15% of the variance; and for graduate students the primary predictor was completeness of readings notes, accounting for 41% of the variance (see Table 11). What is puzzling about this pattern is that the primary predictor was different for every single class, cutting across both readings and class discussion measures as well as all notetaking dimensions.

Most of the correlations between notetaking and exams were higher for sophomores than for any other class. The correlational patterns were relatively similar for sophomores and juniors, but the correlations generally diminished for seniors and graduate students. Most of the correlations between notetaking and exam scores were in the moderate range for sophomores and juniors, whereas most of the correlations were in the weak range for seniors and graduate students.

The class-based regression analysis for exam scores showed that accuracy of class notes was the primary predictor of exam scores for sophomores, accounting for 37% of the variance. Completeness of class notes was the

Table 11

Significant Notetaking Predictors by Class for Performance Variables

Performance variable	Class	Notetaking predictors	Percentage of explained variance
Quizzes	Soph	Acc CL	38%
	Jun	Len R	27%
	Sen	Com CL	15%
	Grad	Com R	41%
Exams	Soph	Acc CL	37%
	Jun	Com CL	32%
	Sen & Grad	(not computed)[a]	
Projects	Soph	Acc CL	13%
	Jun	Com CL	31%
	Sen	Com CL	38%
	Grad	(not computed)[a]	

(table continues)

Table 11 Continued.

Performance variable	Class	Notetaking predictors	Percentage of explained variance
Course grades	Soph	Acc CL	50%
	Jun	Com CL	36%
	Sen	Acc CL	20%
	Grad	(not computed)[a]	

Note. Soph = sophomores (n = 61), Jun = juniors (n = 37), Sen = seniors (n = 21), and Grad = graduate students (n = 9).

[a]Not computed because of violation of assumptions for regression analysis.

primary predictor of exam scores for juniors, accounting for 32% of the variance. The primary predictors of exam performance were not identified for seniors and graduate students because the data did not satisfy some of the assumptions for regression analysis for those two classes.

Most of the correlations between notetaking variables and project scores were in the weak to moderate range. As previously noted, the correlations between notetaking and project scores were most pronounced for seniors. Although graduate students yielded two negligible correlations, the remaining correlations tended to be higher than those for sophomores and juniors. However, the importance of the higher correlations for seniors and graduate students is diminished by the fact that the ns for these groups were much smaller than those for sophomores and juniors.

In the class-related regression analysis for projects, accuracy of class notes was the primary predictor for sophomores (accounting for 13% of the variance); completeness of class notes was the primary predictor for juniors (accounting for 31% of the variance); completeness of class notes was also the primary predictor for seniors (accounting for 38% of the variance); and again the regression analysis was not done for graduate students

because of violation of assumptions underlying regression analysis.

Perhaps because exams constituted a substantial percentage of the course grade, class comparisons were quite similar for exams and total grades. In the latter case, the correlations for sophomores were consistently higher than for any other class. The magnitude of correlations for juniors was slightly lower than those of sophomores, whereas the correlations for seniors and graduate students were substantially lower than those for sophomores.

The class-related regression analysis for course grades revealed that the primary predictor of grades for sophomores was accuracy of class notes, accounting for 50% of the variance; the primary predictor for juniors was completeness of class notes, accounting for 36% of the variance; and the primary predictor for seniors was accuracy of class notes, accounting for 20% of the variance. Again, the regression analysis could not be done for graduate students because of violation of assumptions underlying regression analysis.

Relationship Between Notetaking and Course Evaluation

Table 12 shows the pattern of correlations between the notetaking variables and course evaluation data for the total sample. It was assumed that student course evaluations are affected by the amount of time and effort a student puts forth in a class. Because notetaking is a course activity requiring considerable time and effort, it was hypothesized that notetaking would be predictive of course evaluation. Table 12 indicates that, while several notetaking variables were significantly related to students' course evaluations, notetaking was not a strong predictor of course evaluation.

Only three notetaking variables had significant (yet weak) relationships with the course evaluation data. Respectively, those variables were length of class notes, total notes, and accuracy of class notes. Of these three variables, length of class notes and accuracy of class notes were the best predictors of course evaluations.

Gender Comparisons. Table 13 shows the relationship between notetaking variables and the course evaluation data for both males and females. All correlations for both males and females were in the weak range. No significant

Table 12

Correlations Between Course Evaluation Data and Notetaking and Performance Variables

Notetaking variable	Course evaluation	Performance variable	Course evaluation
Com R	.082	Essay Quizzes	.101
Com CL	.088	Unit Exams	.100
Len R	.162	Projects	.068
Len CL	.235**	Final Exam	.123
Acc R	.111	Total Grade	.096
Acc CL	.181*		
Tot Note	.188*		

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

Table 13

Correlations Between Notetaking and Course Evaluation Data Across Gender and Classes

	Gender		Class			
Notetaking variable	Males	Females	Soph	Jun	Sen	Grad
Com R	.217	.057	.168	-.073	.149	.475
Com CL	.131	.083	.189	-.122	.056	.503
Len R	.241	.160	.196	.087	.321	.302
Len CL	.142	.277**	.261*	.192	.334	.531
Acc R	.234	.093	.190	-.048	.218	.431
Acc CL	.214	.197	.336**	-.020	.046	.715*
Tot Note	.218	.201*	.240	.090	.313	.459

Note. Soph = sophomores, Jun = juniors, Sen = seniors, and Grad = graduate students.

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

relationships were found for males, where females yielded significant relationships between course evaluations and length of class notes (.277) and total notes (.201). It appears that notetaking had more of an impact on female students' satisfaction with course content and structure than was the case for males.

Academic Classification. The examination of the relationship between course evaluation data and notetaking by class revealed that most correlations were in the weak to moderate range. In most comparisons, the graduate students produced the highest correlations between course evaluation data and all notetaking variables. As noted earlier, graduate students consisted of only nine students, limiting the generalizability of this finding.

Excluding graduate students, sophomores were the only class that had significant relationships between the class evaluation data and any of the notetaking variables (accuracy of class notes, .336; length of class notes, .261). Juniors, on the other hand, were the only group of students to have negative correlations with any of the variables. Though weak, completeness of readings notes, completeness of class notes, accuracy of readings notes,

and accuracy of class notes all had a negative relationship to the course evaluation data for juniors.

Chapter IV

Discussion

The central purpose of this study was to determine the efficacy and efficiency of notetaking in accounting for success in large sections of an undergraduate human development course that required student mastery of extensive information and conceptual frameworks. The principal comparisons were between notes over readings and notes over class discussions. Within each of these broad domains, the completeness, length, and accuracy of notes were evaluated with respect to their predictive potential.

Relationship Among Notetaking Variables

In terms of predicting total notetaking in the course, readings notetaking was more highly correlated with total notetaking than was class notetaking. A regression analysis indicated that length of readings notes accounted for 92% of the variance in total notetaking. Thus, it appears that counting the number of words used to answer study questions over readings would yield approximately the same notetaking distribution across students as did the total notetaking score.

Research Methodology

The comparison of correlations across dimensions of notetaking raises questions about the efficiency of scoring procedures for these different measures. Most of the specific notetaking variables correlated substantially with total notetaking. Although the correlations of the completeness measures with total notetaking were a bit weaker than comparable length and accuracy correlations, computation of completeness (a count of the number of questions attempted) took far less time than computation of the other notetaking variables. Accuracy (a conceptual comparison between the student's notes and the instructor's notes) took the most time to compute. That was the case even though only 20% of the questions within sections were rated for accuracy. Had all the questions been rated for accuracy, an enormous difference would have emerged between time for computing completeness and time for rating accuracy.

Relationship Between Notetaking and Performance

A more practical issue than how strongly a notetaking measure is related to total notetaking is the linkage of that notetaking variable to performance measures. A notetaking variable could be related weakly to other

notetaking variables, yet related strongly to performance measures. Correlations between completeness and performance measures were generally on par with the correlations between the other notetaking dimensions and performance measures. In absolute terms, however, the accuracy measures generally yielded higher correlations with the performance variables than did the completeness and length dimensions. Plus, the regression analyses showed that the accuracy dimension, either for readings or class notes, was the most powerful predictor of every performance measure in the course. The regression analyses revealed that completeness of notes was not a significant predictor of a single performance measure. Thus, even though completeness is the most efficient notetaking dimension to compute, it does not yield the same predictive potential as do the other dimensions (especially accuracy).

The comparison of readings notes and class notes points to the latter as the more powerful predictor of every performance measure except quizzes. Because the brief essay quizzes were based exclusively on the readings, it is not surprising that readings notetaking was a more powerful predictor of quiz scores than was class notetaking. More

specifically, accuracy of readings notes was the only significant predictor of quiz scores.

Notes over class discussion, most especially accuracy of class notes, proved to be the strongest predictor of every performance measure except quizzes. Perhaps reflected in the accuracy measure is the amount and quality of effort that students invested in the course. Class notes typically required that students be present in class, stay awake, listen closely to what the instructor was saying, and record in the students' own words the ideas presented. Thus, when students are having difficulty with courses structured like the one described in this study, the most constructive strategy might be to assist the student in learning how to take accurate notes over class discussion.

The two performance measures employed across units were essay quizzes and multiple-choice exams. In addition to knowing how the notetaking measures were related to the composite quiz and exam totals, it is important to determine whether the nature of these relationships varied across units. Except for one unit, the last one in the course, notetaking over readings was more strongly correlated with quiz scores than was notetaking over class discussion. For total exam scores, notetaking over class

discussion was a better predictor than was notetaking over the readings. Although this pattern was not apparent for the first unit in the course, it was generally consistent for the remaining units. Perhaps students learned from the first exam experience that issues discussed in class would be strongly represented on the exams. An analysis of exam questions revealed that 44.5% of the questions were directly from the reading material, 40.5% of the questions were directly from the class material, and 15% of the questions were derived from both the reading and class materials on both the first exam and the remaining unit exams. Students may have been accustomed to exams being more heavily linked to reading materials than to instructor presentations in class.

Relationship Between Notetaking and Student Characteristics

Another basic issue in the course was whether males and females would differ in their notetaking patterns and in the relationships between notetaking and performance measures. Consistent with much past research on the relationship between gender and notetaking, females did better on all notetaking variables than did males. However, for some performance variables (quizzes and projects), notetaking was more strongly related to performance for

males than females. The reverse was the case for exams and course grades. For every single performance measure, the primary notetaking predictor was different for males and females. However, with the exception of prediction of quiz scores for females, a class discussion notetaking dimension was the most powerful predictor for both males and females. For males, length of class notes was the most consistent predictor across performance measures; whereas, for females, the picture was mixed. Nonetheless, accuracy of class notes was the most powerful predictor for both exams and course grades for females.

Comparison of notetaking measures by academic levels yielded no significant differences. Even the raw score means were remarkably similar across grade levels. This pattern is different from that usually reported in the literature: advanced students have been found to take more complete notes (record more critical points) than beginning students. Perhaps one can assume a degree of academic maturity in the current sample that may not be typical of many samples comparing freshmen through seniors. The lowest academic level represented in the current sample was sophomores, and most of the students in the study had already decided on teacher education as their major. Thus,

most participants had probably developed considerable understanding as to what it takes to be successful in courses.

The format for notetaking undoubtedly reduced the notetaking differences across academic level. The study guide identified essentially every issue that should be targeted in the students' notes. Thus, many of the decisions about what to include in one's notes had already been made by the instructor. Had students been left to structure their own notes, a difference across academic classification might have been more likely.

Despite the overall similarity in notetaking proficiency across academic levels, the relationship between notetaking variables and performance measures did differ somewhat by academic classification. For sophomores (the largest class in the study), accuracy of class discussion notes was the best predictor of every performance measure. For juniors (the second largest class), completeness of class notes was the best predictor of three out of four performance measures. The only exception to this trend for juniors was length of reading notes as the best predictor of quiz scores. The regression analyses were incomplete for seniors and graduate students

because these groups were small in size. Nonetheless, the regression analyses that were done indicated that completeness and accuracy of class notes were the major predictors for seniors, and completeness of reading notes was the best predictor of quiz scores for graduate students (the only regression analysis done for this group). In the main, class note dimensions (especially accuracy and completeness) were the best predictors of performance across classes.

Relationship Between Notetaking and Course Evaluations

Course evaluations completed by students appear to be minimally related to the notetaking variables or the performance variables in the course. Interestingly, the correlations between the course evaluation data and four of the notetaking variables (length of reading notes, length of class notes, accuracy of class notes, and total notes) were higher than any of the correlations between course evaluations and the performance variables, indicating that students are not completing course evaluations based on class performance alone. Though notetaking itself may not have a strong relationship with course evaluations, time and effort put forth by students may be a good predictor of course evaluations. Other variables not addressed in the

study (e.g., preparation time for performance measures, time spent reading course material, time spent reviewing material for class) might all be better predictors of course evaluation data.

Gender did not affect the relationship between course evaluation data and notetaking variables. Similar relationships were found for both males and females; females had more significant correlations only because the males' sample size was small (n = 28). The notetaking variables that were significant for the entire sample were the same for the female students.

Academic level slightly affected the relationship between the notetaking variables and the course evaluation data. The most experienced students had the highest relationship between the notetaking variables and course evaluation data; however, because of the limited sample size of that group, none of the relationships were significant. Excluding the results of the junior class, it appears that some characteristics of notetaking may have an impact on the course evaluations. It is clear that notetaking has a stronger relationship with course evaluation data than with performance measures.

Limitations of the Study

The findings of this study are primarily generalizable to highly structured courses that use a partial-notetaking format. Less structured courses in which students create their own structure for notetaking might yield different results regarding the notetaking dimensions assessed in this study. Also, courses using other types of performance assessment (e.g., major essay exams, open-ended projects) might find a different value for notetaking from that found in this study.

A second limitation concerns the statistics used for the study. Stepwise regression was used; however, based on guidelines presented in Tabachnick and Fidell (1996), violations regarding sample size and the number of independent variables existed in this study. This study should be viewed as exploratory research because of these violations.

Another limitation of the current study was the restricted number of participants in several of the subcategories of students. There was a substantial difference between the number of males and females in the study. Thus, one should be cautious in generalizing the findings to other courses that may be more male populated

or more gender balanced. Also, the small number of seniors and graduate students made it difficult to discriminate findings between the upper- and lower-level students.

The way course evaluation was assessed constitutes another limitation in this current study. The course evaluation questionnaire was tailored to the PES 210 course. Its psychometric reliability and validity had not been established prior to its use in the current study.

Conclusions of the Study

A synthesis of the myriad analyses reported in this study points to the following major findings: (a) Most notetaking variables had some predictive potential for some performance measures for some groups; (b) accuracy of class discussion notes was the best predictor of most performance measures for the total sample; (c) females were better notetakers than were males; (d) correlations between notetaking variables and both exam scores and course grades were higher for females than males, but the correlations between notetaking and both essay quizzes and project scores were higher for males than females; (e) the academic classes were equally proficient in notetaking, with the best notetaking predictors of performance mainly being class-discussion notetaking; (f) the correlations between

notetaking variables and course evaluation data were better than the correlations between the performance variables and the course evaluation data, but neither notetaking nor performance variables were substantially correlated with course evaluations.

The conclusions of this study are most generalizable to courses that have a strong content base. Notetaking as a whole might be much less important in courses that are primarily process oriented. Also, the results would likely be most generalizable to courses having a variety of explicit performance measures, including objective exams, essay quizzes, and projects. The predictive potential of notetaking variables would likely be much more limited in courses where students are evaluated exclusively in terms of open-ended projects.

Given a focus on content and explicit performance measures, the major contributions of this study are two-fold: (a) It is one of few studies that examined notetaking patterns and their predictive potential over a full semester's course; (b) it differentiated notetaking patterns and predictive potential across different domains (readings and class discussion) and dimensions within domains (completeness, length, and accuracy of notes). Very

little attention had been given to notetaking over reading materials in past notetaking research, and seldom had previous studies differentiated among dimensions of notetaking to the degree done in this study. Because notetaking had already been established as a strong predictor of performance variables in courses similar to the one described in this study, it was important to determine more precisely what domains and dimensions of notetaking best predict what types of performance variables. That is the principal contribution of the current study. In delineating the predictive value of different facets of notetaking over a full-semester course, the current study is one of the most extensive investigations of notetaking available in the literature on college teaching.

Recommendations for Future Study

Recommendations for future research include accounting for the weaknesses previously mentioned in this chapter. The notetaking dimensions used in this current study should be assessed within other notetaking formats. Also, notetaking differences may be determined more reliably between upper- and lower-level students with larger samples of seniors and graduate students.

Given that notetaking over class lecture was a powerful predictor of performance in the PES 210 class and possibly in most college-level courses, more research needs to be devoted to evaluating the efficacy of instruction in notetaking. This research should evaluate longitudinally student notetaking ability before and after formal instruction on how to take notes. Formal instruction on notetaking may significantly increase the percentage of critical points recorded from class discussions. As a result, student performance may be significantly increased.

A third recommendation is to conduct similar studies in different fields to determine if notetaking is more important in some subject areas than in others. For example, is notetaking more or less critical in social science than in natural science courses? It is important to determine what method of notetaking will be most beneficial to students enrolled in each type of class.

A fourth and final recommendation is to conduct qualitative research to further delineate what factors contribute to student satisfaction in a course similar to that used in the current study. It is especially important to have a better understanding of how study effort (e.g., notetaking, study time) contributes to course satisfaction.

Although previous research had shown that notetaking was a more powerful predictor of total course performance than was either attendance or entry-level critical thinking and that notetaking was the most highly rated dimension of the course targeted in the current study, actual notetaking measures in the current study were only weakly related to course evaluation. Interviews with students regarding their experience of notetaking in the course might reveal perspectives of the linkage between notetaking and course satisfaction that were not evident in the strictly quantitative analysis of the current study.

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