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Margaret L. Mjoness

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The Effects of Situation, Level of Processing, and Individual Differences on Calibration of Comprehension

By
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B. S., North Dakota State University, 1990

Presented in partial fulfillment of the requirements for the degree of Master of Arts University of Montana 1993

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Metacognitive activities are employed daily to assess one's knowledge for specific facts and general level of information in an area, as well as periodic self-assessments of one's own knowledge of memory functioning and beliefs regarding that functioning. Calibration of comprehension, or the accuracy with which the self-assessment correlates with performance, becomes a valuable skill for students to possess when allocating study time. Recent studies have examined factors influencing calibration of comprehension in laboratory settings. Reported calibration of comprehension accuracy has been very low. The accuracy of calibration within group variance has been reduced by splitting the groups on reading ability, suggesting that some individuals are more skillful in the application of metamemorial judgments than are other individuals.

The present study was conducted to examine a limited number of individual differences associated with the ability to calibrate comprehension accurately and a comparison of the levels of processing in classroom and laboratory settings. The three hypotheses tested were: calibration of comprehension will be more accurate in the classroom than in the laboratory situation; subjects using a deep processing strategy will demonstrate more accurate calibration; and calibration will be positively correlated with knowledge of memory functions, efficacious beliefs regarding memory, and reading comprehension.

A total of 134 subjects participated in 2 weekly quizzes as part of an Introduction to Psychology course, predicted postdicted, and made confidence judgments on 7 test items per quiz. The subjects also participated in a laboratory exercise. They read 2 text selections from a psychology text, were tested on the material, and made the same judgments as described for the classroom quizzes. Subjects completed the Metamemory in Adulthood Inventory (Dixon & Hultsch, 1983), Inventory of Learning Processes (Schmeck, Ribich, & Ramanaiah, 1977), reading span test (Daneman & Carpenter, 1980), and the Shipley-Hartford Institute of Living Scale.

The findings support the hypotheses of more accurate calibration in the classroom setting than in the laboratory and that classroom use of a deep processing strategy increases calibration accuracy. The individual difference measures did not correlate significantly with calibration of comprehension.
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CHAPTER I

Introduction

Self-assessment of memory, comprehension, and confidence in self-knowledge are processes used in academic learning and evaluation. Some students seem to predict their own performance more accurately than others, and accuracy of prediction has been related to measures of test performance (Maki & Berry, 1984; Pressley, Borkowski, & O'Sullivan, 1984), familiarity with the material (Glenberg, Sanocki, Epstein, & Morris, 1987), levels of processing (Maki, Foley, Kajer, Thompson, & Willert, 1990; McDaniel, 1984; Schommer & Surber, 1986), and the difficulty of the test items (Fischhoff, Slovic, & Lichtenstein, 1977). Often there is a discrepancy between self-assessment of knowledge and actual performance.

Memory and metamemory (knowledge of one's own memory) differences demonstrated by individuals in classroom and laboratory learning situations appear not to have an isolated source, but rather they stem from a complex interaction of variables (Flavell & Wellman, 1977). Not only do individuals vary greatly in the skills and attributes they bring to a learning situation, but also the learning situation places widely varying demands. The purpose of this study is to investigate a select sampling of these variables and to identify how they interact in both classroom and laboratory settings with respect to metamemory.
and memory performance.

Relationship of Variables

The separation of metacognitive skills from cognitive skills remains a theoretical debate. Studies to clarify the distinction between the two constructs have resulted in mixed conclusions, dependent on the methodology employed and the underlying assumptions of what constitutes separability.

To demonstrate the differences of cognition from metacognition, Slife, Weiss, & Bell (1985) matched learning disabled students with regular students on three measures of cognitive ability and found differences in metacognition. The learning disabled students were less knowledgeable about cognitive processes and had less effective self monitoring skills supporting the conclusion that memory and metacognition are different functions. Cavanaugh & Borkowski (1980) reported similar findings in a study of elementary school children. The degree of verbalized knowledge of memory, metamemory, was not related to memory performance. This separation may be due more to the inability of children to introspect and verbalize metamemory knowledge than lack of a relationship between the two constructs.

The development of metamemory and strategy knowledge may become more effective at directing memory activities as a person develops cognitively (Fisher, 1980; Flavell & Wellman, 1977). Developmental studies with children
demonstrated trends in some areas of metamemory, such as: memory monitoring (Wellman, 1977), use of retrieval cues (Fabricius & Wellman, 1983), strategy development, prediction of memory span, and recall readiness (Flavell, Friedrichs, & Hoyt, 1970). Age differences in prediction accuracy continue into adulthood.

Bruce, Coyne, & Botwinick (1982) report older adults (age 60-79) overestimated their performance on recall of word lists, while younger adults (age 20-31) were more accurate in their recall predictions. A similar study testing recall and confidence judgments on questions of general knowledge failed to show any age differences (Lachman, Lachman, & Thronesbery, 1979). As older adults reported having a decreased memory capacity (Hultsch, Hertzog, & Dixon, 1987) which may affect learning new items, the adult age differences may be related to current learning situations rather than recall of long-term memory items.

Metamemory

The knowledge of memory functions, strategy efficiency, and strategy monitoring has been labeled metamemory. Metamemory is then the "executive control," dictating the choice of memory strategies and monitoring strategy effectiveness, altering strategies as necessary. The measurement of metamemory has been developed along two lines: 1) the use of questionnaires to investigate overt knowledge regarding memory processes, and 2) the measurement
of the application of the monitoring process by having subjects predict their performance on a memory task.

**Metamemory Assessment**

A questionnaire developed by Dixon & Hultsch (1983) assesses knowledge and beliefs of memory processes and self-reported memory functioning. The Metamemory in Adulthood (MIA) questionnaire differentiates seven subscales or dimensions of metamemory which can be grouped into two categories, memory self-efficacy and memory knowledge. Memory self-efficacy, including the capacity, change, anxiety, and locus subscales, is a measure of beliefs about one’s own competencies. The memory knowledge category includes the strategy, task, achievement, and anxiety subscales.

Three forms of metamemorial judgments, as identified by Leonesio & Nelson (1990), differ in their predictive accuracy and appear to tap memory in differing ways. Ease-of-learning (EOL) judgments are made before exposure to the material to be learned and reflect how easy the subject judges the learning task. EOL judgments are predictive of learning rate, but not of test performance (Leonesio & Nelson, 1990). Judgments made prior to learning have also been investigated by Glenberg et al. (1987) as familiarity with the topic, or domain familiarity. Domain familiarity appears to be a factor in determining confidence in comprehension.
The second type of judgment is judgment-of-knowing (JOK). JOK's are made at or after learning and prior to testing, or after testing. At this point (post-learning, pre-testing) in learning, a metamemorial judgment may prove critical to the student, as an inaccurate judgment may lead to premature termination of test preparation. JOK accuracy is more accurate after testing (King, Zechmeister, & Shaughnessy, 1980) when the subject has additional information on which to base a judgment but the opportunity to alter the testing outcome is no longer available.

Estimating the likelihood of recognizing non-recalled items, or feeling-of-knowing (FOK) judgments, is not highly correlated with EOL or JOK (Leonesio & Nelson, 1990).

Calibration of Comprehension

One aspect of metamemory is calibration of comprehension, defined as the "correlation between subjective assessments of knowledge gained from reading and performance on an objective test" (Glenberg, et al., 1987). If this subjective assessment of comprehension forms the basis for decisions related to mental effort, as suggested by Lachman et al. (1979), then the accuracy of this assessment is a critical aspect of education.

When comprehension is judged accurately, a person would be able to predict test performance with little error. However, studies with children, college students, and older adults have failed to consistently confirm accurate
calibration of comprehension in laboratory settings. Overestimation of comprehension is commonly reported (Fischhoff et al., 1977; Glenberg, Wilkinson, & Epstein, 1982; Maki & Berry, 1984) with subjects performing with less accuracy than they predicted. This mismatch has been labelled the "illusion of knowing" (Glenberg et al., 1982). They conclude that the assumption of comprehension is made unless there is contradictory evidence. In contrast, King, Zechmeister, & Shaughnessy (1980) found that subjects can accurately predict performance when learning paired-associate word lists and rating confidence in recall at the time of learning. In a text learning and multiple choice testing format Pressley and Ghatala (1988) found that some students had perfect calibration, but the overall trend was toward over-confidence.

Likert type scales are most frequently employed as measures of confidence on multiple choice questions. However, the incidence of overestimation or illusion of knowing, does not appear to be a function of measurement. When subjects use percentage judgments, odds judgments, or bet money on their responses, overconfidence is generally evident (Fischhoff et al., 1977).

An effect of the number of test items employed in calibration of comprehension research has been elucidated by Weaver (1990). The use of a single test item, as used by Glenberg & Epstein (1985, 1987) and Glenberg et al. (1987),

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severely restricts measurement and results in underestimation of calibration of comprehension. As the number of test items per text increases, so does the sensitivity of measurement. Another concern with the use of Likert type scales is the individual application of the scales and the possibility that all responses tend to group at the high end of the scale. Schommer & Surber (1986) demonstrated sufficient variability in scale use between groups, suggesting that the measurement method does not artificially control subject responses.

Strategies

The application of a specific strategy to a learning situation has been shown to have a positive effect on memory performance (Barclay, 1981). The effect was enhanced when subjects understand the value of the strategy's usefulness (Paris, Newman, & McVey, 1982; Pressley et al., 1984). However, some subjects failed to use an effective strategy even when they are knowledgeable about it (Waters, 1982). Regardless of the type of test they expected (Feldt & Ray, 1989), college students studying expository texts frequently used rote learning strategies and text underlining. Underlining did not appear to increase overall comprehension, but increased retention only of the underlined material (Johnson, 1988). Generally, the use of an elaboration strategy had the most benefit on later recall or recognition tests (Waters, 1982), and was the strategy
chosen by most subjects following experience with elaboration strategy and subsequent testing (Pressley, Levin, & Ghatala, 1984).

The various manipulations used to alter processing and recall of text material can be divided into three main categories. An "instructional set" or "advance organizer" guides the reader in a goal directed manner. Secondly, questions inserted before, during, or following the text, focus the reader's attention and serve a self-testing function to evaluate text comprehension. Finally, various text manipulations to alter the processing of central ideas of a text or the entire text, for example: underlining, highlighting, and deleting letters. All of the above demonstrated some effect on subsequent testing performance.

From a levels-of-processing point of view, deeper processing of material results in better recall and comprehension. Adams (1980) suggested that processing at too shallow a level was the cause of comprehension monitoring failure. Shallow processing therefore resulted in reduced accuracy of calibration of comprehension as well as performance. Schommer & Surber (1986) used shallow versus deep processing instructions with two difficulty levels of expository text to explore the illusion of knowing (IK). Those using shallow processing (read to rate clarity of passage) and reading the more difficult text had the highest incidence of IK. Analysis of the errors made by
this group included a high proportion of distortions and misunderstanding of the material, not lack of understanding. Those matching processing level appropriately to the task at hand were most successful in making accurate comprehension judgments.

Text Differences

Different types of texts (descriptive and fairy tales) were used by McDaniel, Einstein, Dunay, & Cobb (1986) to determine the types of processing typically employed with different types of materials. They concluded that encouraging processing of an alternative type to that invited by the nature of the text results in greater recall.

Using a deleted letters paradigm (text with 2-4 letters per word replaced with blanks) designed to increase active processing during reading, McDaniel (1984) found memory was increased for important ideas, and Maki, Serra, et al. (1990) reported an increase in accuracy of test predictions in addition to improved test performance. The deletion of letters in a text alters the processing, but may have also served a self-testing function as the subject searches memory to fill in the deleted letters.

To further study the effect of processing on test predictions, Maki, Serra, et al. (1990) used texts with the important idea units highlighted. They found this manipulation, without the self-testing aspect of the deleted letters paradigm, also resulted in improved accuracy of
predictions. Both the deleted letters and highlighting paradigms increased the amount of time subjects spend reading the texts. The increased reading time suggested that a deeper level of processing is being used.

As demonstrated by improved calibration of comprehension with inclusion of questions in a text (Walczyk & Hall, 1989), the self-testing function also seemed to increase prediction accuracy. The presence of questions may serve as an external cue to monitor and evaluate the level of comprehension, or the questions may alter the level of processing by encouraging a deeper level of understanding.

The Inventory of Learning Processes (ILP), developed by Schmeck, Ribich, & Ramanaiah (1977), assesses the individual differences in learning processes or preference for types of learning strategies. Four scales, identified in the context of academic study, measure differences in information processing, organizational processes, encoding, and study techniques. The Synthesis-Analysis (later labeled Depth of Processing) and Elaborative Processing scales measure active processing, or the use of a deeper level of processing. Students scoring high on these scales would be expected to be more accurately calibrated on measures of comprehension. Performance on multiple choice tests may not be so clearly predicted. The Fact Retention scale may relate to accurate responses on questions of a factual and semantic nature, while the Elaborative Processing scale has been
significantly correlated with testing performance in an educational setting (Schmeck & Grove, 1979).

The Synthesis-Analysis scale was significantly correlated with college Grade Point Averages (GPA) and scores on the American College Testing (ACT) Program Assessment (Schmeck & Grove, 1979). The authors concluded that these correlations were due to the successful student being more attentive to higher level ideas, without exclusion of details and specific information.

Reading Comprehension

Reading, as used in the academic setting, constitutes more than simple decoding of symbols into meaning. The goals of the reader dictate the additional processes required to achieve the desired level of understanding. For college students reading text material in preparation for an examination, the symbols must be decoded and their meanings understood in context, aiding overall comprehension of the text. In addition, the mature reader selects a reading strategy, monitors the efficiency of the strategy, and modifies related cognitive processes as necessary (Forrest-Pressley & Waller, 1984, p. 6). The actual processes employed by the reader are determined by metacognitive knowledge and monitoring (Flavell, 1977).

Measures of reading comprehension are dependent on the aspect of comprehension being assessed and the theoretical definition of comprehension. Standardized reading
comprehension tests have been utilized widely as a predictor of school performance and tend to be highly correlated with measures of general intelligence. Tests such as the Nelson-Denny reading test are largely measures of recall, which is one indicator of future performance. Although these measures may have fairly accurate predictive power, the lack of specificity does not allow for analysis of individual differences. A more specific approach proposed by Daneman and Carpenter (1980) involves measuring working memory capacity and processing efficiency by a reading span test. Working memory, involving both processing and storage functions, varies across individuals in the proportion of limited resources devoted to processing versus storage. Daneman and Carpenter's theory proposes that as efficiency increases, less resources are involved in processing, resulting in more capacity available for storing and maintaining information. As processing demands increase, the storage abilities decrease; therefore a task making incrementally more taxing processing demands and measuring the storage ability would evaluate the efficiency of this system. The reading span test (Daneman & Carpenter, 1980) has been shown to be highly correlated with verbal comprehension and measures of integration in longer units of text (Daneman, 1981).

Test Items

Multiple choice test items result in differential
calibration of comprehension when the item content and difficulty was considered (Pressley & Ghatala, 1988). Comprehension test items, requiring inferential processing and choosing between partially correct distractors, resulted in the least accurate calibration when compared with analogies and opposites in a multiple choice format (Pressley & Ghatala, 1988).

Test items vary along at least two continua that contribute to the relative ease or difficulty of an item: concrete to abstract, and cognitive level (Tanner, 1988). Previously these two were thought to vary in a parallel manner (Bloom, 1956). However, the recent study by Tanner (1988) in which test items were classified by level in each of the two dimensions demonstrated an interaction between the two measures of difficulty.

Tanner (1988) defines the terms "abstract" and "concrete" as follows:

1. Concrete concepts have perceptible attributes: the attributes of the concept can be perceived through the senses. The words are more 'picturable'.
2. Concrete words have greater meaning in isolation. They are words which are learned without the necessity of having learned other words.
3. Abstract terms derive their meaning largely through verbal experiences.
4. Abstract concepts have attributes that cannot be
directly perceived, cannot be ‘pointed to’.

5. Abstraction requires the manipulation of spatially and temporally remote events.

Using the above criteria to judge test items as abstract or concrete, Tanner (1988) identified test items described by categories one and two as concrete. Test items categorized into divisions four and five above are labeled abstract, with category three being neither concrete or abstract. The cognitive dimension is divided into recall and higher-than-recall items. The recall items, or knowledge-level questions, requires the student to "remember the idea or phenomenon in a form very close to that in which it was originally encountered" (Bloom et al., 1956). Higher-order questions require that learned material be applied or manipulated in a way different from its original presentation.

Self-efficacy

In addition to the external manipulations of text and test items and the individual differences of each subject, the subjects' beliefs about learning and memory have an impact on the learning process. Specifically, memory self-efficacy has been related to adult age differences in memory and metamemory. Perceived self-efficacy on memory tasks was predictive of performance, even when controlling for previous performance (Bandura, 1989). People with efficacious self-beliefs utilized attentional and cognitive
resources in a more active manner, had an orientation toward success, and were strongly committed to challenging goals (Bandura, 1989). It is for these reasons that subjects with high beliefs in their capabilities may tend to be overly optimistic when making performance predictions. Bandura (1989) suggests that the over confidence reported in several studies can be viewed as personally beneficial instead of detrimental as it encourages perseverance and increases motivation. These differences in resource utilization and motivation affect the level of cognitive effort directed at a learning task and, therefore, alter the outcome on performance measures.

In a cross-cultural study of elementary children Schneider, Borkowski, Kurtz, and Kerwin (1986) found that motivation influenced metamemory and recall for both American and German children. They also reported that American children attribute success in an testing situation to effort rather than luck or ability. Attribution of success to effort has also been found to be related to children's level of metamemory (Kurtz & Borkowski, 1984).

Studies involving the MIA identified Memory Self-Efficacy (MSE) and Memory Knowledge (MK) as two higher order factors of metamemory (Hultsch, Hertzog, Dixon, & Davidson, 1988). The MSE factor has age differences across the adult life span, with older adults perceiving a reduced control over memory (Hultsch et al., 1988). The MSE factor includes
those scales that measure competency beliefs about the individual's memory functioning and abilities.

**Gender**

Some laboratory studies suggest gender differences in metamemorial judgments. High school females were less confident in their responses but more realistic than male peers (Newman, 1984). Adult women tended to use strategies more frequently than men but also reported more anxiety related to memory tasks than do men (Hultsch et al., 1987). Although women have demonstrated higher scores on some measures of reading comprehension than men, this does not imply superior calibration of comprehension.

**Achievement**

Achievement measures, such as college GPA and ACT scores, are generally predictive of performance and are indicators of the effectiveness of past academic efforts made by the individual. Several studies have found that "better students," as measured by various achievement scores, also score higher on measures of metamemory.

**Intelligence**

One reason for the differences found on metamemory measures as related to achievement scores is the possibility of underlying differences in intelligence. Intelligence assessments are also highly correlated with measures of verbal comprehension and related skills that are considered important for the development of metamemory. Studies with
children have not found significant metamemory differences in relation to measures of intelligence, but it is unclear if this is also the case for college students.
CHAPTER II
Purpose and Hypotheses

This study investigated the individual differences associated with accuracy of calibration of comprehension in a college classroom setting and in a laboratory setting. Previous studies, based on laboratory experiments, concluded that subjects are frequently not very well calibrated and are most often over confident in their predictions and confidence judgments. The purpose of this study was to utilize an actual college learning situation to determine the degree of calibration evident when several modes of learning are available and the experience was more meaningful. Accuracy of memory monitoring has educational implications for teaching effective learning strategies that enhance metamemory and aid the efficiency of the learner in allocating time and effort.

Various laboratory manipulations and the skills and attributes of the individuals being studied influence metamemory and calibration of comprehension. The classroom provides a richer learning experience with additional opportunities for monitoring and self-testing than are available in a laboratory setting. Increased accuracy in classroom quiz predictions and postdictions (JOK's) over laboratory JOK's was predicted. Due to multi-modal exposure to the material and the increased meaningfulness of the quiz, test item confidence judgments should also be more
accurate in the classroom than the laboratory.

Students utilizing a learning style that incorporates a deeper level of processing (ILP scales Deep Processing and Elaborative Processing) were expected to be more accurate on calibration of comprehension in the classroom. Those scoring high on the reading span test were predicted to be more accurate calibrators in both situations. Test items judged as abstract and higher-than-recall were predicted to be the least accurate on calibration of comprehension measures.

Both in the laboratory and the classroom subjects scoring above the median on the MSE measure of the MIA were expected to be somewhat over-confident in their test predictions and postdictions due to the effect of perceived self-efficacy on predictions of performance.

No gender effect was expected on calibration of comprehension accuracy due to lack of consistent gender differences in previous studies. Achievement and IQ were expected to interact with performance and the Memory Knowledge section of the MIA in a positive direction, but not with calibration of comprehension, predictions, and postdictions.
CHAPTER III

Method

Subjects

Subjects were 134 students from the introductory psychology course at The University of Montana. Participation in the study served as partial course requirement for the subjects. The experimenter recruited the subjects for participation in this study by direct solicitation in the two classrooms. Prior to consent to participate, subjects were provided with a description of the tasks involved in the study. See Appendix A for "Subject Information" script.

Materials

Subjects completed a brief demographic information form including age, gender, GPA, and years of education. (See Appendix B)

At the time of each quiz each subject completed a form for recording quiz predictions, confidence judgments, and postdictions. (See Appendix C) The experimenter premarked the recording forms with the subject’s identification number. Before receiving the quiz, the subjects made a pre-test judgment of the number of items (out of seven) that they predicted to answer correctly. Seven Likert-type scales corresponding to each of the seven test items followed the instructions. On the reverse side of the form subjects indicated a post-test judgment of total correct
The experimenter selected texts for Part Two from chapters 7 and 13 of *Psychology an Introduction* (6th ed.), by C.G. Morris (1990). The single spaced typed texts were each seven pages (26 to 34 paragraphs) long. (See Appendix D) Experimenters administered the Inventory of Learning Processes (ILP) (Schmeck, Ribich, & Ramanaiah, 1977) to each subject to assess the level of processing the subjects used in applied situations. Deep Processing, Elaborative Processing, Fact Retention, and Methodical Study are the four scales comprising this 62 item true/false inventory. (See Appendix E)

Each subject completed the Metamemory In Adulthood (MIA) (Dixon & Hultsch, 1983) instrument, consisting of 108 items scored on a five point Likert scale, as a measure of memory knowledge and memory self-efficacy. These two measures have been identified as higher-order factors that are a weighted combination of the seven scales included in the MIA. (See Appendix F)

An experimenter individually administered the reading span test (Daneman & Carpenter, 1980) to each subject as a measure of working memory efficiency. The reading span test consists of a series of sentences each presented in elite type on an 8 X 5 inch index card for the subject to read aloud. Immediately upon completion of reading the sentence, the experimenter presented the next card. Following verbal
instructions, the subject learned the task of recalling the final word of each sentence in a set during 5 trials on sets of 2 sentences. Experimenters provided feedback during the trial phase. The cards were presented in sets of five with an increasing number (two to six) of sentences per set until the subject failed to correctly recall all of the final words on two out of five sets.

A blank card separated the sets, which the subject used as a cue to start recall of the last word of each of the sentences read in that set. The words could be recalled in any order with the exception of recalling the word from the last sentence first. Self-corrections were accepted if offered before the next set began. The highest level (number of sentences in a set) completed with an accuracy of 3 or more on 5 attempts determined the score. Subjects earned an additional half point for a set in which 2 out of 5 were recalled correctly. (See Appendix G)

Subjects completed the group administered form of the Shipley Institute of Living Scale as an estimate of intelligence.

Procedure

The experiment was conducted in two phases. The first phase consisted of classroom quiz measurements and the second phase included two laboratory sessions of one hour and one and one half hours duration. The author and two research assistants collected the data in this study.
During Part 1 (classroom) each subject participated in two weekly tests with seven text items each (each test consists of 10 items, 7 from the text which were used for analysis and 3 from lectures which were not analyzed). The subject predicted test performance on the seven items before reading any of the test items. After answering each of the seven multiple choice items, the subject indicated response confidence on a four point scale corresponding to that test item. The scale was labelled numerically (25, 50, 75, 100) and with corresponding word labels (just guessing, not sure, quite sure, and very sure).

Following completion of the test, the subject made a postdiction on the reverse side of the form used above, indicating the total number expected to be correct out of seven. The prediction, confidence judgments, and postdiction were indicated on a form separate from the test and then collected by an experimenter. The experimenter added the performance results to each recording form after the tests were graded by the instructor.

Subjects followed the same procedure in the laboratory (Part 2). Prior to the presentation of the two texts, experimenters gave verbal instructions to "read to rate the clarity of the text" or "read to teach another student the main points" (Schommer & Surber 1986). (See Appendix H for verbatim instructions)

Random assignment allotted equal numbers of subjects to the
"accurate" and "inaccurate" groups and the deep/shallow processing groups (groups determined by methods stated in the Results section). Following instructions and presentation of the text materials, students read each text during a 20 minutes time period. Subjects completed two tests, seven items each, and made predictions, confidence judgments, and postdictions as they had done in the classroom.

While in the laboratory setting, subjects completed the Metamemory in Adulthood Inventory, Inventory of Learning Processes, the reading span test, and the Shipley Institute of Living Scale.

Subjects completed the laboratory tasks in groups of 1-16 (most were in groups of 10-16 and a few were tested in small groups of 1-2) in a setting allowing adequate space for each subject. Classroom tests were administered in groups of 6-14 students per room.

Following the concrete to abstract definitions stated by Tanner (1988) and recall versus higher-than-recall dimension (Bloom et al., 1956), experimenters analyzed all test items (classroom and laboratory) for difficulty and content. Three experimenters classified the test items into one of four categories (higher-than-recall and abstract, higher-than-recall and concrete, recall and abstract, or recall and concrete)(see Appendix I). The experimenters resolved discrepancies in classification by discussing the
rationale and reviewing criteria were presented in random starting order with rotation by item type (incomplete counterbalancing).

Debriefing followed the laboratory portion of the study. The experimenter encouraged any subject requesting additional information to talk to the experimenter and to register for a copy of the study results. (See Appendix J)
CHAPTER IV

Results

The results are organized into three sections. The first section describes the demographic features of the subjects included in this study. The second section describes the analyses of calibration of comprehension. The third section examines the measures of individual differences and the relationships between these measures and those described in the first two sections. Results are reported at the .05 level of probability.

Demographic Data

One hundred and thirty-four subjects from two sections of introductory psychology completed all aspects of the study. The subjects consisted of 62 females and 72 males with a mean age of 21.43 years (sd = 4.67, range = 18 - 47) and one to five years of college education (M = 1.73, sd = 1.04).

Calibration of Comprehension

The data were analyzed with a 2 X 2 mixed-design, with the between-subject variable of level of processing and within-subject variable of learning situation. Random assignment determined the level of processing variable in Part 2, while in Part 1 scores on the ILP determined this variable. The ILP scales, Depth of Processing and Elaborative Processing (deep processing), were summed and compared with the sum of the ILP Methodical Study and Fact Retention scales (shallow processing) to determine the level of processing category.
A median split of the differences between deep processing scales and shallow processing scales divided the subjects into two groups (deep processors and shallow processors) for Part 1 of the study.

Two separate calibration coefficients (Goodman-Kruskal Gamma) were calculated for each subject. The dependent variables are classroom and laboratory measures of correlation between confidence ratings and performance on each test item calculated for each subject by level of processing. The experimenter eliminated four subjects from the analysis by means of a random number table to equalize the cells to 65 subjects per cell. See Table 1 for the means and standard deviations of these correlations.
Table 1

<table>
<thead>
<tr>
<th>Learning Situation</th>
<th>Level of Processing</th>
<th>Deep</th>
<th>Shallow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td></td>
<td>.796</td>
<td>.452</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.423)</td>
<td>(.442)</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td>.363</td>
<td>.294</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.465)</td>
<td>(.489)</td>
</tr>
</tbody>
</table>

Note. n = 65 per cell, standard deviation in parentheses.

A 2 X 2 analysis of variance (ANOVA) was conducted on the mean gammas displayed in Table 1. The interaction of Level of Processing (LOP) and Learning Situation (LS) was significant, $F(1, 128) = 5.45$, $p = .0211$, $MS_\epsilon = 1.226$. The classroom LS was more accurate in calibration of comprehension across levels of processing than the laboratory LS, $F(1, 258) = 60.24$, $p < .0001$, $MS_\epsilon = 5.665$. The level of processing effect was also significant across learning situations with the deep processing condition exhibiting more accurate calibration than the shallow processing condition $F(1, 128) = 12.32$, $p = .0006$, $MS_\epsilon = $
2.772. (See Figure 1.)

**Figure 1.** Calibration Accuracy as a function of Learning Situations and Levels of Processing. (Goodman-Kruskal Gamma Correlations)

![Graph showing calibration accuracy as a function of learning situations and levels of processing.](image)

A further comparison illuminated a differential pattern in the effects of the level of processing variable. In the classroom LS the deep LOP condition resulted in significantly greater accuracy than the shallow LOP condition, $F(1,128) = 17.08$, $p < .0001$, $MS_e = 3.842$, whereas in the laboratory LS no significant effect of LOP was noted, $F(1,128) = .69$, $p = .4071$, $MS_e = .156$. A verification of the power of the instructional set used in Part 2 was not determined and the possible implications of this will be discussed in a later section.
Analyzing these data across levels of processing to examine the configuration of results by learning situation showed a dissimilar pattern across learning situations. Using a deep LOP had a notably greater effect on calibration accuracy in the classroom LS than the laboratory LS, \( F(1, 321) = 44.23, p < .0001, \text{MS.} = 6.08 \). The shallow LOP also effected calibration accuracy differently across learning situations with the classroom LS again displaying significantly more accurate calibration, \( F(1, 321) = 5.89, p = .0157, \text{MS.} = .810 \).

In considering the data presented above it is of interest to look at the patterns of performance and judgments of knowing (JOK).

Subjects predicted their performance on 7 item tests before seeing the tests and after completing the tests. Pearson product-moment coefficients (r) correlating these prediction and postdiction JOK’s with performance are presented in Table 2. No significant differences on the JOK’s by experimental condition were noted and therefore this analysis is not detailed here. All of the mean JOK correlations were significantly different from zero and the prediction/performance correlation was significantly lower than the prediction/postdiction, \( t(133) = 4.49, p < .0001, \text{SE} = .037 \), and postdiction/performance correlations, \( t(133) = 5.31, p < .0001, \text{SE} = .0431 \).
Table 2
Judgment of Knowing (JOK) Mean Correlations and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Performance</th>
<th>Postdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction</td>
<td>.348</td>
<td>.514</td>
</tr>
<tr>
<td></td>
<td>(.489)</td>
<td>(.453)</td>
</tr>
<tr>
<td>Performance</td>
<td>.576</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.457)</td>
<td></td>
</tr>
</tbody>
</table>

Note. n= 134. Pearson product-moment coefficients.

The mean number correct differed significantly between the classroom and laboratory quizzes. (See Figure 2.) The classroom deep LOP had the most elevated performance mean of 11.30 (sd = 2.35) which was significantly higher than classroom shallow LOP performance (M = 10.39, sd = 1.61), t(132) = 2.61, p = .01, SE = .3488. The laboratory test performances did not differ significantly from each other, t(126) = 1.1, p=.2755, SE = .4707. Collapsing performance over learning situations demonstrated a tendency toward higher performance in the deep LOP over shallow LOP but not significantly so, t(130) = 1.71, p=.0889, SE = .4186.
Figure 2. Performance on test items by Learning Situation and Level of Processing.

The alterations made in judgments after answering the test questions moved toward more accurate predictors of performance than pretest judgments. The direction of movement is depicted in Figure 3. Of interest was the change in pattern across learning situations depicting more confidence in the classroom judgements with increased accuracy and a diminished magnitude of over-confidence. The mean differences between classroom test predictions and performances were .88 (SD = 1.48) and .10 (SD = 1.41) respectively, while the laboratory mean differences were 2.0 (SD = 1.81) and 1.55 (SD = 1.76).
Figure 3. Prediction versus Performance Discrepancy and Postdiction versus Performance Discrepancy by Learning Situation.
Subjects improved their JOK accuracy on the postdiction in both learning situations. The mean differences between classroom test postdictions and performances were .33 (SD = 1.19) and .11 (SD = 1.19). The laboratory postdiction JOK’s improved in accuracy as well, with mean differences of 1.07 (SD = 1.75) and .80 (SD = 1.65) per test.

The test item type was not analyzed due to the extreme unequal frequency of test item types presented in the classroom situation. The test items were not under experimental control in the classroom situation and an analysis of test items revealed that questions actually used were 90% recall (61% abstract and 29% concrete) and only 10% higher-than-recall. Seventy-two percent of the classroom test items were abstract and 29% concrete. Possible implications for this inequality are addressed in the discussion section of this paper.

The laboratory questions were equally distributed among the four types identified earlier but did not yield sufficient quantity of data to calculate individual gammas. Gammas calculated on the laboratory question types are presented in Figure 4 for descriptive purposes only. Concrete higher-than-recall questions were most accurately assessed in relation to performance ($G = .6619$) while abstract higher-than-recall questions were the least accurately calibrated ($G = -0.0349$). Less differences were noted on the recall question calibrations with the concrete
recall gamma of .3794 and abstract recall gamma of .2702.

**Figure 4.** Calibration Coefficients as a Function of Test Item Type in the Laboratory Learning Situation.
Individual Difference Measures

The measures of processing used in the classroom situation (ILP), memory knowledge and memory self-efficacy (MIA), reading span test (rst), IQ (Shipley), course grade, GPA, gender, age, and years in college are presented in Table 3.

Table 3

Means, Standard Deviations, and Ranges of Individual Difference Measures

<table>
<thead>
<tr>
<th></th>
<th>ILP Deep</th>
<th>ILP Shallow</th>
<th>MIA</th>
<th>MIA MK</th>
<th>MIA MSE</th>
<th>rst</th>
<th>IQ</th>
<th>Course Grade</th>
<th>GPA</th>
<th>Age</th>
<th>Years College</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>21.1</td>
<td>14.47</td>
<td>211.92</td>
<td>182.43</td>
<td>2.62</td>
<td>105.19</td>
<td>2.84</td>
<td>2.77</td>
<td>21.43</td>
<td>1.73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.64)</td>
<td>(.03)</td>
<td>(17.41)</td>
<td>(12.89)</td>
<td>(.883)</td>
<td>(10.11)</td>
<td>(.99)</td>
<td>(.657)</td>
<td>(4.67)</td>
<td>(1.04)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>29</td>
<td>28</td>
<td>256</td>
<td>221</td>
<td>5</td>
<td>124</td>
<td>4.0</td>
<td>4.0</td>
<td>47</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

A multiple regression analysis of the above data failed to provide an adequate equation for the prediction of calibration of comprehension. Table 4 presents the significant correlational relationships of the individual difference measures.
Table 4

**Significant Coefficients of Correlation with Individual Difference Measures**

<table>
<thead>
<tr>
<th></th>
<th>IQ</th>
<th>ILP Deep</th>
<th>ILP Shall ow</th>
<th>Course Grade</th>
<th>MIA MSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR COC</td>
<td>.172</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAB COC</td>
<td>.401</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ILP Deep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ILP Shall ow</td>
<td>.304</td>
<td>.297</td>
<td>.218</td>
<td>.307</td>
<td>.182</td>
</tr>
<tr>
<td>Grade</td>
<td>.215</td>
<td>.281</td>
<td>.26</td>
<td>.343</td>
<td></td>
</tr>
<tr>
<td>GPA</td>
<td></td>
<td>.187</td>
<td>.306</td>
<td>.416</td>
<td></td>
</tr>
<tr>
<td>MIA/M SE</td>
<td></td>
<td>.181</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIA/M K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER V
Discussion

This study demonstrates the difference in calibration of comprehension between classroom and laboratory settings. The subjects in the classroom utilizing a deep processing strategy made more accurate estimates of their knowledge than those using a shallow level of processing. Subjects in the laboratory did not demonstrate the difference of processing level. Classroom subjects achieved higher mean performance.

Differences in the levels of processing variable make interpretations difficult. In the classroom situation subjects used their preferred learning strategies while laboratory subjects used an assigned level of processing. The lack of significant effect noted in the level of processing variable in the laboratory measures may be due to ineffectual manipulation of this variable, an artifact of measurement sensitivity, or true absence of effect in this situation due to an unidentified cause. The absence of a measure of manipulation effectiveness limits interpretation of these results. The experimenter subjectively assessed that subjects were persuaded by the manipulation, as observed by the subjects' reactions to the instructions and their responses following the study time.

Subjects predicted their test scores prior to seeing the test and postdicted following the test. This
prediction/performance correlation (judgment of knowing) did not differ across conditions. The process of indicating one's knowledge on an individual item and predicting a total score appear to involve different processes of self-assessment.

The tendency toward overconfidence reported in previous studies was replicated in the laboratory aspect of this study, but a different pattern emerged from the classroom data. When involved in an actual class testing situation, students more accurately judged their knowledge and tended to be more conservative in their overall estimations of performance.

Looking at the direction of error in pre-test judgments to performance scores illuminated an interesting pattern. On a classroom quiz students were not only more accurate at predicting, but made fewer errors in the direction of overconfidence than they did in a laboratory setting. By the time students entered the testing situation they had quite a reliable idea of the quiz outcome.

These findings are encouraging in their implications for study time allocation decisions. When given a fixed amount of reading time in the laboratory, students indeed performed poorly on calibration of comprehension tasks. Fortunately this did not appear to be the case when applied to the classroom. It was not within the scope of this study to assess which differences between the classroom and
laboratory contributed to the differential effects on calibration. Personal relevance, mode of information presentation, consequences of achievement, and processing time are likely topics of inquiry.

Order of testing was not manipulated in this study due to the constraints of using actual classroom data. The classroom tests were the 3rd and 4th weekly tests of the academic quarter. All students had previously taken two tests, so they had the benefit of some prior experience with the type of tests offered and their personal outcome on the previous two tests. The laboratory measures occurred following the classroom measures, so the benefit of experience was weighted in favor of better calibration of comprehension in the laboratory to prevent unfair bias toward the hypothesis of this study. This indeed strengthens the results of more accurate calibration in the classroom, however the effect of question type makes the data interpretation less clear.

The analysis by question type was impeded by the lack of distribution of recall versus higher-than-recall questions used in the classroom. It is unknown if this is a function of the specific test bank or a trend in introductory college courses. With the preponderance of recall questions (90%) it leads one to consider what the most efficient study strategy may be. Those using a deep level of processing achieved higher average scores in the classroom than those
using a shallow level of processing but there is a reward for rote memorization with the unequal distribution of direct recall questions. Further study is needed to evaluate the influence of question type on classroom calibration of comprehension.

The qualitative difference in question type between classroom and laboratory situations makes meaningful interpretation of this data difficult without further study of the nature of the interaction of question type and learning situation. As identified in earlier studies (Pressley & Ghatala, 1988), questions of a more concrete type requiring less inference and questions that test recall of specific text information are more accurately calibrated. Given that these are the types of questions that were used in the classroom (concrete and recall), it is expected that calibration would be more accurate than on the mix of question types employed in the laboratory. Experimental study of this interaction with control over question types or balancing of question types is required to clearly delineate the impact of learning situation versus question type in the college students' accuracy of calibration.

The correlational data revealed no significant relationships with gender or the class section. No significant correlation between the classroom and laboratory calibration of comprehension gammas was noted ($r = -0.043$). This supports a situational impact over the effect of
individual differences. With additional research to identify the situational aspects that are most salient with regards to calibration, modification of these variables may be possible.

In summary, college students were more accurate at calibration of comprehension on a classroom test than in the laboratory. An investigation into the relationship of several individual difference measures with calibration did not reveal a predictive combination of attributes to account for accurate calibration. The findings suggest that the effect of the learning situation has a potent influence on calibration accuracy. Further research is needed to identify specific situational variables affecting these differences.
REFERENCES


SUBJECT INFORMATION

The opportunity to participate in this study will be offered following a brief introduction to its purpose and the tasks that will be involved.

This study examines various aspects of memory and testing that affect most college students. The results are expected to give some important insight into the processes students use and the effects on testing. As you know, many studies on memory are conducted in laboratories, but this study is interested in looking at real classrooms to see if what occurs in the lab is also what happens in class. More detailed information on the purpose will be available following completion of the study.

The following information is provided for your consideration in deciding to participate in this experiment. The required tasks that include the following:

1. Making predictions about 2 weekly test scores.
2. Making judgments about your test answers, twice.
3. Participating in a laboratory segment that will consist of paper and pencil tasks.

An important part of this study includes making predictions and judgments on a form at the time you are taking your Thursday test, for 2 weeks. This information will have absolutely no effect on your grade. Your proctor and instructor will not have access to this information at any time. The form will be provided at the time of the test and will be collected by an experimenter, ensuring confidentiality. To further ensure confidentiality, identification on the forms will be indicated by number, so only the experimenter will be able to identify the subjects.

Agreement to participate in this study includes an agreement for experimenter access to your completed tests. Following the data collection phase, all names and identifying information will be destroyed.

Following completion of all of the above tasks, you will receive 6 experimental units for participation in this study. If you withdraw before completion of the laboratory portion, you will receive partial credit.

Although there is no evidence to suggest that participating in this type of study will have any effect on your test performance, please notify the experimenter immediately to withdraw if at any time you feel that this procedure is having a negative effect on your performance.
Appendix B

DEMOGRAPHIC INFORMATION

Subject #______________

Age:_______

Gender: Male
    Female

Years of Education after High School: 1  2  3  4

GPA (Grade Point Average) while in college (if you have been in college for 2 quarters or more) _______
Appendix C

RECORDING FORM

Subject #_________

1. BEFORE reading any items on the test:
   Indicate your prediction on the first 7 items on this test. I will score ___ out of 7 correct.

2. Following each of the first 7 questions indicate by circling 1 option (word or number) which of the 4 options on the bar most closely represents your confidence in your answer.

   1. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   2. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   3. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   4. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   5. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   6. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure

   7. 25_________ 50_________ 75_________ 100
      just not quite very
guessing sure sure sure
3. Following completion of the test, answer the following:
   Of the first 7 items on this test, I scored __ out of 7 correct.
Appendix D

COGNITION AND LANGUAGE

If someone were to ask you, "What is cognition, or thinking?" you might respond with something as broad as "Thinking is what goes on inside your head." And indeed this is not a bad answer. Cognitive processes play a role in many psychological functions. A clue to the vast range of things involved in thinking can be seen in the different ways we use the word. "I've given it some thought" implies reflection or meditation. "I think this town is like the one I grew up in" indicates conceptualization. "What does she think of all this?" is a way of asking for an evaluation. "Aha! I think I'll buy the red one" indicates a decision. These are all examples of thinking. Thinking includes the processing and retrieval of information from memory. But in addition, it requires manipulation of information in various ways.

We have seen that thinking is relevant to such diverse processes as attention, sensation and perception, learning, memory, and forgetting. Later we will see how cognition bears a crucial relation to intelligence, coping and adjustment, abnormal behavior, and interpersonal relations. In this chapter, we will first look at the building blocks of thought - the kinds of things we think about - and then study the ways in which we use these building blocks in problem-solving and decision-making. Then we will examine language and the role it plays in thinking.

BUILDING BLOCKS OF THOUGHT

Images and concepts are the two most important building blocks of thought. When you say that you are thinking about your father, you may have an image of him - probably his face, but perhaps also how he sounds when he is talking or the scent of his favorite after-shave lotion. But you can also think about your father by using various concepts or categories that help you to recall him - concepts like, man, father, taxpayer, butterfly collector, gentle, strong. In the first part of this chapter, we will consider the role that images play in thinking. Then we will explore concepts and their relationship to thought.

IMAGES

Stop reading and think for a moment about Abraham Lincoln. Then think about being outside in a summer thunderstorm. Your thoughts of Lincoln probably included such words as President, slavery, Civil War, and assassinated. But you probably also had some mental images concerning Lincoln: his
bearded face, perhaps, or his lanky body, or a log cabin. When you thought about the thunderstorm, you probably formed mental images of wind, rain, and lightning. An image is a mental representation of a sensory experience; it can be used to think about things. We can visualize the Statue of Liberty or astronauts hopping around on the surface of the moon; we can smell Thanksgiving dinner; we can hear Martin Luther King, Jr., saying, "I have a dream!" In short, we can think by using sensory images.

Moreover, researchers have found that we not only visualize things in order to think about them, we manipulated mental images. Shepard and Metzler (1971), for example, presented subjects with pairs of geometrical patterns. In some cases, the two pictures were of the same pattern rotated to provide different views. In other cases, the two pictures were of different patterns. Subjects were asked to determine whether each pair of patterns was the same or different. The researchers discovered that subjects invariably rotated the image of one pattern in their minds until they could see both patterns from the same perspective. Then subjects tried to see if the mental image of one pattern matched the other pattern. The more a pattern had to be rotated, the more time it took to match it to the other. In other words, a pattern that had to be mentally rotated 180 degrees would take longer to compare than one that had to be rotated 90 degrees. Subsequent tests have supported these findings. It seems that we can and do manipulate mental images in order to help us think about things.

Images allow us to think about things in nonverbal ways. Albert Einstein relied heavily on his powers of visualization in order to understand phenomena that would later be described by complex mathematical formulas. Einstein believed that his extraordinary genius resulted in part from his skill in visualizing the possibilities of abstract conceptions. Although few of us manage to match Einstein's brilliance, we nonetheless use imagery as an effective aid in thinking about and solving problems. All of us have watched a teacher clarify a difficult idea by drawing a quick, simple sketch on a blackboard. Many times, when words make a tangled knot of an issue, a graphic image drawn on paper straightens out the confusion. Images also allow us to use concrete forms to represent complex and abstract ideas. For example, you have no doubt seen a pie chart of a budget in which each item is represented by a wedge, the size of which varies according to its percentage of the budget. You can mentally compare the sizes of each wedge and imagine how the pie would look if a particular item received a larger or smaller wedge. Thus, images are an important part of thinking and cognition. Now let's examine concepts, another important building block of thought.
CONCEPTS

Concepts are mental categories for classifying specific people, things, or events based on their common features. Dogs, books, and cars are all concepts that let us categorize objects in the world around us. Fast, strong, and interesting are also concepts that we can use in categorizing objects. When you think about an object - say a Ferrari - you usually think of the concepts that apply to it: for example, fast, sleek, expensive car. Thus, concepts help us think more efficiently about things; without the ability to form concepts, we would need a different name for every individual object.

Concepts also give meaning to new experiences. We do not stop and form a new concept for every new experience. We draw on concepts that we have already formed and place the new object or event into the appropriate categories. In the process, we may modify some of our concepts to better match the world around us. Consider, for example, the concept of professor. You probably had some concept of professor before you ever attended any college classes. In all likelihood your concept changed somewhat after you actually met some professors and took your first college courses. Perhaps your concept became more accurate: You might realize now that professors are not all absentminded, that some professors are not even 30 years old - in fact, that most professors are not very different from all the other people whom you have come to know. Your concept will become fuller as you add new information about professors based on your experiences at college. In the future, because you have formed a concept of professor, you will not have to respond to each new professor as a totally new experience; you will know what to expect and how you are expected to behave. Conceptualizing professor (or anything else) is a way of grouping or categorizing experiences so that every new experience need not be a surprise. We know, to some extent, what to think about it.

Interestingly, some recent research suggests that humans may not be unique in their ability to form concepts. For example, Edward Wasserman and his colleagues at the University of Iowa trained pigeons to peck different buttons when shown pictures of cats or people, flowers, cars and chairs. Once the pigeons mastered the task, they were shown a new set of pictures of cats, flowers, and so on. Remarkably, the pigeons were able to correctly categorize the new pictures about 70 percent of the time. It seems that they had learned the essential features that distinguish, say, cats from other objects, and were able to apply that learning to pictures they had never seen before.
PROTOTYPES

It is tempting to think of concepts as simple and cut. But psychologists have discovered that most of the concepts that people use in thinking are neither clear nor unambiguous. Rather, they are "fuzzy": they overlap one another and are often poorly defined. For example, most people can tell a mouse from a rat. But most of us would be hard pressed to come up with an accurate list of the critical differences between mice and rats.

If we cannot explain the difference between mouse and rat, how can we use these concepts in our thinking? The answer seems to be that we construct a model (or prototype) of a representative mouse and another prototype of a representative rat, and then use those prototypes in our thinking. Our concept of bird, for example, does not consist of a list of key attributes like feathered, winged, two feet, and lives in trees. Instead, most of us have a model bird, or prototype, in mind—such as a robin or a sparrow—that captures for us the essence of bird. When we encounter new objects, we compare them to this prototype in order to determine if they are in fact birds. And when we think about birds, we usually think about our prototypical bird.

Most people would agree that a robin somehow expresses "birdness" more than a penguin does. It more nearly fits our prototypical image of a bird. But prototypes are seldom perfect models. Robins, for example, do not contain every single feature that can be possessed by birds. For example, they do not have the talons of an eagle. Because natural categories are fuzzy, prototypes are only the best and most suitable models of a concept, not perfect and exclusive representations of it. As Lindsay and Norman (1977) point out, "The typical dog barks, has four legs, and eats meat. We expect all actual dogs to be the same. Despite this, we would not be too surprised to come across a dog that did not bark, had three legs, or refused to eat meat". We would still be able to recognize such an animal as a dog.

How, then, do we know which objects belong to a concept? For instance, how do we know that a lion is not a bird but that a penguin is a bird? The answer is that we decide what is most probable or most sensible, given the facts at hand. This is what Rosch calls relying on the degree of category membership. For example, a lion and a bird both have two eyes. But the lion does not have wings, it does not have feathers, and it has four feet and a mouth full of teeth—all of which indicate that it is quite unlike our prototype for a bird. Thus, we are able to eliminate lions from the general category of birds. On the other hand, penguins share many features that belong to our prototype for a bird. As a result, we recognize these Arctic creatures as members of the bird family even though they lack feathers and don't
fly.
So far we have seen how images and concepts form the building blocks of thought. In the next section we will turn our attention to the ways in which we use images and concepts to make decisions.

DECISION MAKING

Decision-making differs from other kinds of problem-solving in that we already know all the possible solutions (choices). The task is to select the best alternative by using a predetermined set of criteria. Sometimes we have to juggle a fairly large and complex set of criteria. As this set grows, so do the difficulties in reaching a good decision. For example, suppose that we are looking for an apartment. The amount of rent is important, but so are the neighbors, location, level of noise, and cleanliness. If we find a noisy apartment with undesirable neighbors but a bargain-basement rent, should we take it? Is it a better choice than the apartment in a more desirable location with less noise, but with a somewhat higher rent? How can we weigh the various characteristics in order to ensure that we make the best possible decision from among the various choices?

If you were to proceed logically, you would use some kind of compensatory model to arrive at a decision. In this case, you would rate all of the choices on each of several criteria in order to see how the attractive features of each choice might compensate for the unattractive ones. For example, if you are buying a house, one criterion might be that you prefer a brick house. You might, however, buy a wooden house if it is located in a good school district, has a pleasing floor plan, and is reasonably priced. In this case, the attractive features compensate for the fact that the house is not brick.

One of the most useful compensatory models includes the various criteria, with each assigned a weight according to its importance. Consider the decision involving the purchase of a new car, and only three criteria are considered: price (which is not weighted heavily, weight = 4), gas mileage (weight = 8), and repair record (weight = 10). Each car is then rated from 1 (poor) to 5 (excellent) on each of the criteria. Each rating is then multiplied by the weight for that criterion and the result is put next to the rating. Then the numbers are added to give a total for each car.

Using a model like this one allows you to evaluate a large number of choices on a large number of criteria. It can be extremely helpful in making choices such as which college to attend, which job offer to accept, which career to pursue, and where to take a vacation. If you have properly weighted the various criteria and correctly rated each alternative in
terms of each criterion, then you can be sure that the alternative with the highest total score is in fact the most rational choice given the information available to you.

Most people, however, do not follow such a precise system of making decisions. Rather, they use various noncompensatory models. Especially popular is the elimination-by-aspects tactic. In this case, we toss out specific choices if they do not meet one or two of our requirements, regardless of how good they are on other criteria. For example, we might eliminate a car, regardless of all its advantages, because "it costs more". As you might guess, noncompensatory models tend to be shortsighted. They do not help us weigh the values of particular features, nor do they invite us to compare all the alternatives. As a result, such a model can lead to a decision that is merely adequate, but not the best.

Sometimes, we mix both compensatory and noncompensatory strategies to settle on a decision. When there are many alternatives and many criteria, we may use a noncompensatory approach to eliminate any choices that are especially weak on one or more criteria, even though they may be strong on other criteria. When the field has been narrowed to a few alternatives, all of which are at least average on the various criteria, then we might adopt some form of compensatory decision model.

We also decide among different decision models according to how much is at stake. We are more likely to use a compensatory model when the stakes are high: buying a home or choosing a college. When the stakes are low, the noncompensatory model usually helps us to decide quickly such casual matters as which shoes to wear or who we think might win an Academy Award.

But even in important matters it is not always easy to make rational decisions. Sometimes, for example, information about an alternative is uncertain. In the case of the two cars, we may not know the repair record of either car, perhaps because both are new models. In this case, we have to make some estimates based on information about past repair records, which then help us to predict the repair records of these new models. In some of the facts that we need to make a decision, and research indicates that in many cases our guesses may not be correct.

Tversky and Kahneman (1973) conducted one experiment in which students at a particular university were asked to choose whether a student who was described as "neat and tidy," "dull and mechanical," and a "poor writer" was a computer science major or a humanities major. More than 95 percent chose computer science as the major. Even after they were told that more than 80 percent of the students at their school were majors in humanities, the estimates remained virtually unchanged. This exemplifies how people use the heuristic of representativeness: A decision is made
on the basis of certain information that matches a stereotyped model. For example, many people discriminate vocationally against the elderly without considering a particular person’s ability to do the job. They have a stereotype of the elderly being incapable of certain tasks and judge a given individual as being representative of the general model.

Another common heuristic is availability. In the absence of full and accurate information, we often make decisions based on whatever information is most easily retrieved from memory, even though this information may not be accurate. In one experiment, subjects were asked whether the letter r appears more frequently as the first or third letter in English words. Most people said first, but the correct answer is third. Their estimates were incorrect because they relied on the most readily available information in their memories, and it is easier to recall words that begin with r than words that have r as their third letter.

As we all know, however, people do manage to make serviceable decisions in the real world. In part, this is because it is often possible to revise decisions if it appears that an initial choice is not optimal. Moreover, real-world decisions often don’t have to be ideal or optimal, as long as the results are acceptable. An investment that returns a 20 percent profit in one year is still a fine investment, despite the fact that another investment might have returned 25 percent or 30 percent. Einhorn (1980) discusses a similar case regarding strategies for accepting people into a professional school. The admissions officers may adopt a strategy that leads to an 80 percent success rate among those applicants accepted. They would conclude that they had a good admissions model, even if the reality is — unknown to the admissions officers — that 90 percent of the rejected applicants also would have been successful students.

On the other hand, there are situations in which "close is not good enough." Spettle and Liebert (1986) studied the potential for error in decision-making among operators at nuclear power plants. They found that in addition to the kinds of heuristic errors that we have been discussing, the stress of an emergency situation causes decision-making to deteriorate further. Great stress may even erode performance to the point of panic. On the other hand, they suggest that people can be trained to meet novel situations in which quick and accurate decisions are crucial. With training that simulates actual emergency conditions, people can be better prepared to use efficient and effective decision-making strategies. The Outward Bound program was originally developed because British sailors whose boats were torpedoed panicked and died when calm decision-making would have ensured their survival. This program puts people in a variety of stressful wilderness situations in the
belief that people will learn effective personal strategies that can be transferred to a wide variety of everyday situations.
STRESS AND ADJUSTMENT

HOW PEOPLE COPE WITH STRESS

Whatever its source, stress calls for adjustment. Psychologists distinguish between two general types of adjustment: direct coping and defensive coping. Direct coping refers to any action that we take to change an uncomfortable situation. When our needs or desires are frustrated, we attempt to remove the obstacles between ourselves and our goal or we give up. Similarly, when we are threatened, we try to eliminate the source of the threat, either by attacking it or by escaping from it.

Defensive coping refers to the different ways people convince themselves that they are not really threatened or that they do not really want something they cannot get. A form of self-deception, defensive coping is characteristic of internal, often unconscious conflicts. We are emotionally unable to bring a problem to the surface and deal with it directly because it is too threatening. In self-defense, we avoid the conflict.

DIRECT COPING

When we are threatened, frustrated, or in conflict, we have three basic choices for coping directly: confrontation, compromise, or withdrawal. We can meet a situation head-on and intensify our efforts to get what we want (confrontation). We can give up some of what we want and perhaps persuade others to give up part of what they want (compromise). Or we can admit defeat and stop fighting (withdrawal).

Take the case of a woman who has worked hard at her job for years but is not promoted. She learns that the reason is her stated unwillingness to more temporarily from the company’s main office to a branch office in another part of the country in order to get more experience. Her unwillingness to move is an obstacle between her and her goal of advancing in her career. She has several choices. Let’s look at each in turn.

CONFRONTATION

Confrontation means facing a stressful situation forthrightly, acknowledging to oneself that there is a problem for which a solution must be found, attacking the problem head-on, and pushing resolutely toward one’s goal. The hallmark of the "confrontational style" is making intense efforts to cope with stress and to accomplish one’s aims. This may involve learning skills, enlisting other
people’s help, or just trying harder. Or it may require trying to change either oneself or the situation. The woman whom we have been describing might decide that if she wants very much to move up in the company, she will have to agree to relocate. But she might, instead, try to change the situation itself in one of several ways. She could challenge the assumption that the branch office would give her the kind of experience that her supervisor thinks she needs. She could try to persuade the boss that although she has never worked in a branch office, she nevertheless has enough experience to handle a better job in the main office. Or she could remind the supervisor of the company’s need to promote more women to top-level positions.

Confrontation may also include expressions of anger. Anger can be effective, especially if we have really been unfairly treated and if we express our anger with restraint instead of exploding in rage. A national magazine once reported an amusing, and effective, example of controlled anger in response to an annoying little hassle. As a motorist came to an intersection, he had to stop for a frail old lady crossing the street. The driver of the car behind honked his horn impatiently, whereupon the first driver shut off his ignition, removed his key, walked back to the other car, and handed the key to the second driver. "Here," he said, "You run over her. I can’t do it. She reminds me of my grandmother."

COMPROMISE

Compromise is one of the most common, and effective, ways of coping directly with conflict or frustration. We often recognize that we cannot have everything we want and that we cannot expect others to do just what we would like them to do. In such cases, we may decide to settle for less than we originally wanted. A young person who has loved animals all his life and has long cherished the desire to become a veterinarian may discover in college that he has less aptitude for biology than he had hoped and that he finds dissecting specimens in the lab so distasteful that he could never bring himself to operate on animals. By way of compromise, he may decide to become an animal technician, a person who works as an assistant to a veterinarian.

WITHDRAWAL

In some circumstances, the most effective way of coping with stress is to withdraw from the situation. A person at an amusement park who is overcome by anxiety just looking at a roller coaster can move on to a less threatening ride or even leave the park entirely. The woman whose promotion depends on temporarily relocating might simply quit her job and join another company. Or she might withdraw.
figuratively from the stressful situation by deciding that promotion no longer matters to her and that she has already advanced in her career as far as she wants to go.

We often equate withdrawal with simple refusing to face problems. But when we realize that our adversary is more powerful than we are, or that there is no way we can effectively change ourselves, alter the situation, or reach a compromise, and that any form of aggression would be self-destructive, withdrawal is a positive and realistic adjustment. In seemingly hopeless situations, such as submarine and mining disasters, few people panic. Believing that there is nothing they can do to save themselves, they give up. If the situation is in fact hopeless, resignation may be the most effective way of coping.

Perhaps the greatest danger is that withdrawal will turn into avoidance of all similar situations. We may refuse to go to any amusement park or carnival again. The woman who did not want to move to a branch office may quit her job without even looking for a new one. In such cases, coping by withdrawal becomes maladaptive avoidance, and we begin to suspect that the adjustment is not really effective. Moreover, people who have given up are in a poor position to take advantage of a more effective solution if one comes along. For example, one group of fifth-grade students was given unsolvable problems by one teacher and solvable problems by with problems that could be solved, the students were unable to solve them, even though they had solved nearly identical problems given by the other teacher.

Withdrawal, in whatever form, is a mixed blessing. Although it can be an effective method of coping, it has built-in dangers. The same tends to be true of defensive coping, to which we now turn.

DEFENSIVE COPING

Thus far, we have been speaking of coping with stress that arises from recognizable sources. But there are times when we either cannot identify or cannot deal directly with the source of our stress. For example, you return to a parking lot to discover that someone has damaged your new car and then left the scene. Or your vacation trip must be delayed because the airport is buried under 3 feet of new snow. In other cases, a problem is so emotionally threatening that it cannot be faced directly. Perhaps you find out that someone to whom you are close is terminally ill. Or you learn that after four years of hard study you have failed to be admitted to medical school and may have to abandon your lifelong ambition of becoming a physician.

In all these cases, you are under stress and there is little or nothing you can do to cope with the stress directly. In such situations, people are likely to turn to defense mechanisms as a way of coping. Defense mechanisms
are ways of deceiving oneself about the causes of a stressful situation so that pressure, frustration, conflict, and anxiety are reduced. The self-deceptive nature of such adjustments led Freud to conclude that they are entirely unconscious. Freud was particularly interested in distortions of memory and in irrational feelings and behavior, all of which he considered symptoms of a struggle against unconscious impulses. Therefore, he believed that defensive ways of coping always spring from unconscious conflicts and that we have little or no control over them. Not all psychologists accept this interpretation. Often we realize that we are pushing something out of our memory or otherwise deceiving ourselves. All of us blown up at one person when we knew we were really angry with someone else.

Whether or not defense mechanisms operate unconsciously, they do provide a means of coping with stress that might otherwise be unbearable. Let’s look more closely at some of the major defense mechanisms.

DENIAL

One common defense mechanism is denial, or the refusal to acknowledge a painful or threatening reality. The first reaction of most people when they learn that they are dying is denial. Lazarus (1969) cites the example of a woman who was near death from severe burns. At first, she was depressed and frightened, but after a few days she began to feel sure that she would soon be able to return home and care for her children, although all medical indications were to the contrary. By denying the extent of her injuries, this woman was able to stay calm and cheerful. She was not merely putting on an act for relatives and friends: She believed she would recover. In a similar situation, C.T. Wolff and his colleagues (1964) interviewed the parents of children who were dying of leukemia. Some parents denied their children’s condition; others accepted it. Physical examinations revealed that those who were denying the illness did not have the physiological symptoms of stress, such as excessive stomach acid, found in those who accepted their children’s illness.

Many psychologists would suggest that in these situations denial is a positive solution. But in other situations it clearly is not. Students who deny their need to study and instead spend more nights at the movies may well fail their exams. Heroin addicts who insist that they are merely experimenting with drugs are also deluding themselves.

REPRESSION

Perhaps the most common mechanism for blocking out painful feelings and memories is repression. Repression, a form of forgetting, means excluding painful thoughts form
consciousness. The most extreme form of this defense is amnesia - the total inability to recall the past. Soldiers who break down in the field often block out the memory of experiences that led to their collapse. But forgetting that you are supposed to go for a job interview Thursday morning or forgetting the embarrassing things you said at a party last night may also be instances of repression.

Many psychologists believe that repression is a sign of struggle against impulses that conflict with conscious values. For example, most of us are taught that violence and aggression are wrong. But it is only human to feel anger at least sometimes. This conflict between our feelings and our values can create stress, and one way of coping defensively with that stress is to repress our feelings - to block out completely any awareness of our underlying anger and hostility.

Denial and repression are the most basic defense mechanisms. In denial, we block out situations with which we can't cope. In repression, we block out unacceptable impulses or thoughts. These mechanisms form the bases for other defensive ways of coping.

**PROJECTION**

If a problem cannot be denied or repressed completely, it may be possible to distort its nature so that it can be more easily handled. One example of this is projection, the attribution of one's own repressed motives, ideas, or feelings to others. We ascribe feelings that we do not want to someone else, thus locating the source of our conflict outside ourselves. A corporation executive who feels guilty about the way he rose to power may project his own ruthless ambition onto his colleagues. He is simply doing his job, he believes, while his associates are all overly ambitious and preoccupied with power. A high-school student talks his girlfriend into sneaking away with him for the weekend. It is a bad experience for both of them. Days later he insists that it was she who pushed him into it. He is not lying - he really believes that she did. Perhaps he feels guilty for insisting that they sneak away together, angry with her for not talking him out of it, and disturbed by what he felt during the experience. To pull himself together, he locates the responsibility outside himself. In both cases, the stressful problem has been repressed and then translated into a form that is less stressful and easier to handle.

Dana Bramal (1962) demonstrated projection with an experiment in which heterosexual male subjects were assigned a partner, and some were led to believe that they had measurable homosexual tendencies. Others were not so deceived. Bramal then studied the ways in which the deceived subjects tried to cope with the presumably disturbing "evidence" that they had homosexual tendencies.
Many subjects used projection: In interviews after the experiment, many more experimental than control subjects attributed homosexual tendencies to their partners. In other words, they dealt with the stress by locating the problem outside themselves.

**IDENTIFICATION**

The reverse of projection is identification. Through projection, we rid ourselves of undesirable characteristics that we have repressed by attributing them to someone else. Through identification, we take on the characteristics of someone else in order to share in that person’s triumphs and to avoid feeling incompetent. The admired person’s actions become a substitute for our own. Identification is sometimes considered a form of defensive coping because it enables people to resolve conflicts vicariously. A parent with unfulfilled career ambitions may share emotionally in a child’s professional success. When the child is promoted, the parent may feel as if he or she has triumphed.

Identification is often used as a form of self-defense in situations where a person feels utterly helpless. Psychoanalyst Bruno Bettelheim, once a prisoner in a Nazi concentration camp, described how some prisoners gradually came to identify with the Nazi guards. Over the years, they began to copy the speech and mannerisms of the guards, and sometimes even their values. Bettelheim explains that the prisoners were completely dependent on the guards, who could treat them however they liked. The relationship between prisoner and guard was similar to that between child and parent. Bettelheim suggests that the guards may have consciously been trying to make the prisoners feel like children. For example, prisoners had to ask permission to go to the bathroom. Sometimes permission was denied, forcing grown men to suffer the indignity of wetting their pants. Reduced to a childlike, helpless condition, prisoners reverted to a pattern developed in childhood: They identified with the aggressor. Like children in conflict with a powerful and threatening adult, they admired their enemy and became like him as a way of defensively coping with unbearable and inescapable stress.

**REGRESSION**

People under severe stress, like the concentration camp victims described by Bettelheim, may revert to other kinds of childlike behavior as well. This is called regression. People who become fixated at one of the early Freudian stages (oral, anal, or phallic) are especially likely to display the immature childlike traits associated with those stages whenever they come under stress.

Why do people regress? Some psychologists say that it is...
because an adult cannot stand feeling helpless. Children, on the other hand, are made to feel helpless and dependent every day. Becoming more childlike can make total dependency or helplessness more bearable.

But regression is not always the result of imposed dependency. Adults who cry when their arguments fail may expect those around them to react sympathetically, as their parents did when they were children. Other adults may use temper tantrums in a similar way. In both examples, people are drawing on childish behaviors to solve current problems, in the hope that someone will respond to them the way adults did when they were children. Inappropriate as it may seem, such immature and manipulative behavior often works—at least for a while.

INTELLECTUALIZATION

This defense mechanism is a subtle form of denial. We realize that we are threatened but detach ourselves from problems by analyzing and intellectualizing them, almost as if they concerned other people and did not bother us emotionally. Parents who sit down to discuss their child's difficulties in a new school and hours later find themselves engaged in a sophisticated discussion of educational philosophy may be intellectualizing. They appear to be dealing with their problems but may in fact have cut themselves off from their emotions.

Like denial, intellectualization can be a useful defense under some circumstances. Doctors and nurses see pain and suffering every day of their working lives. They must keep some degree of detachment if they are to remain objective. Bettelheim reports that he felt completely detached on his journey to a concentration camp. He simply did not feel that the experience was happening to him.

REACTION FORMATION

The term reaction formation refers to a behavioral form of denial in which people express with exaggerated intensity ideas and emotions that are the opposite of their own. Exaggeration is the clue to this behavior. The man who praises a rival extravagantly may be covering up jealousy about his opponent's success. The woman who is overly cordial and claims, "I've never had an angry moment in my life" may be coping defensively with repressed hostile feelings that she finds intolerable. Reaction formation may also be a way of convincing oneself that one's motives are pure. The man who feels ambivalent about being a father may devote a disproportionate amount of time to his children in an attempt to prove to himself that he is a good father.
DISPLACEMENT

Displacement is the redirection of repressed motives and emotions from their original objects to substitute objects. Displacement permits repressed motives and feelings to find a new outlet. The man who has always wanted to be a father and learns that he cannot have children may feel inadequate. As a result, he may become extremely attached to a pet or to a sibling's child. The woman who must smile and agree with her boss all day may come home and yell at her husband or children. The new object may not be a fully satisfactory substitute, but it probably provides at least some relief and perhaps allows the person to cope more effectively than would otherwise be possible.

SUBLIMATION

Sublimation involves transforming repressed motives or feelings into more socially acceptable forms. Aggressiveness might be transformed into competitiveness in business or sports. A strong and persistent desire for attention might be shaped into an interest in acting or politics. Curiosity about the human body might be transformed into an interest in painting or photographing nudes.

From the Freudian perspective, sublimation is not only necessary but desirable. If people can transform their sexual and aggressive drives into more socially acceptable forms, they are clearly better off. The instinctual drives are at least partially gratified with relatively little anxiety and guilt. Moreover, society benefits from the energy and effort channeled into the arts, literature, science, and other socially useful activities.

We have seen that there are many different ways of coping defensively, with stress. Is defensive coping a sign that a person is immature, unstable, on the edge of a "breakdown"? The answer is no. The effects of prolonged stress can be so severe that in some cases defensive coping not only becomes essential to survival but even contributes to our overall ability to adapt and adjust. But even in less extreme situations people can profitably use defense mechanisms to cope with problems and stress. As Coleman et al. (1987) point out, defenses are "essential for softening failure, alleviating tension and anxiety, repairing emotional hurt, and maintaining our feelings of adequacy and worth". But when a defense mechanism interferes with a person's ability to function or creates more problems than it solves, it is considered maladaptive.
Appendix E
INVENTORY OF LEARNING PROCESSES

This questionnaire asks you to describe the way you study and learn. There are many different ways to study and learn, any of which may be effective for a particular individual. Since this is the case, there are no "right" or "wrong" answers to these questions. We are simply trying to find out the ways in which people learn best.

Answer TRUE or FALSE to each statement in the questionnaire. If a particular statement applies to you, check TRUE. If a particular statement does not apply to you, check FALSE. In answering each question, try to think in terms of how you go about learning in this class. Be accurate and honest in your answers. Be sure to complete all the items, but do not spend a great deal of time on any one of them. This survey is for research use only and all information is kept confidential.

1. When studying for an exam, I prepare a list of ____ ____ probable questions and answers.

2. I have trouble making inferences. ____ ____

3. I increase my vocabulary by building lists of new terms. ____ ____

4. I am very good at learning formulas, names and dates. ____ ____

5. New concepts usually make me think of many other similar concepts. ____ ____

6. Even when I feel that I have learned the material, I continue to study. ____ ____

7. I have trouble organizing the information that I remember. ____ ____

8. Even when I know I have carefully learned the material, I have trouble remembering it for an exam. ____ ____

9. After reading a unit of material, I sit and think about it. ____ ____

10. I make simple charts and diagrams to help me remember material. ____ ____

11. I generally write an outline of the material I read. ____ ____
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<table>
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<tr>
<td>12. I try to convert facts into &quot;rules of thumb&quot;.</td>
<td>TRUE FALSE</td>
</tr>
<tr>
<td>13. I do well on tests requiring definitions.</td>
<td></td>
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<tr>
<td>14. I usually refer to several sources in order to understand a concept.</td>
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<td>15. I ignore conflicts between the information obtained from different sources.</td>
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<td>16. I spend more time studying than most of my friends.</td>
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<td>17. I learn new words or ideas by visualizing a situation in which they occur.</td>
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<td>18. I learn new concepts by expressing them in my own words.</td>
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<td>19. I often memorize material that I do not understand.</td>
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<td>20. For examinations, I memorize the material as given in the text or class notes.</td>
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<td>21. I carefully complete all course assignments.</td>
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<td>22. I have difficulty planning work when confronted with a complex task.</td>
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<td>23. I remember new words and ideas by associating them with words and ideas I already know.</td>
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<td>24. I review course material periodically during the quarter.</td>
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<td>25. I often have difficulty finding the right words for expressing my ideas.</td>
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<td>26. Toward the end of a course, I prepare an overview of all material covered.</td>
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<td>27. I find it difficult to handle questions requiring comparison of different concepts.</td>
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<td>28. I generally read beyond what is assigned in class.</td>
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<td>29. I have difficulty learning how to study for a course.</td>
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<tr>
<td>30. I have a regular place to study.</td>
<td>TRUE FALSE</td>
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<td>31. I read critically.</td>
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<td>32. I &quot;daydream&quot; about things I have studied.</td>
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<td>33. I do well on completion items.</td>
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<td>34. I make frequent use of a dictionary.</td>
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<td>35. I learn new ideas by relating them to similar ideas.</td>
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<td>36. When learning a unit of material, I usually summarize it in my own words.</td>
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<td>37. I maintain a daily schedule of study hours.</td>
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<td>38. I think fast.</td>
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<td>39. While learning new concepts their practical applications often come to my mind.</td>
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<td>40. I get good grades on term papers.</td>
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<tr>
<td>41. Getting myself to begin studying is usually difficult.</td>
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<tr>
<td>42. When necessary, I can easily locate particular passages in a textbook.</td>
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<td>43. I can usually formulate a good guess even when I do not know the answer.</td>
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<tr>
<td>44. I have trouble remembering definitions.</td>
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<tr>
<td>45. I would rather read the original article than a summary of an article.</td>
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<tr>
<td>46. While studying, I attempt to find answers to questions I have in mind.</td>
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<tr>
<td>47. I can usually state the underlying message of films and readings.</td>
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<td>48. I work through practice exercises and sample problems.</td>
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<td>49. I find it difficult to handle questions</td>
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<td>50. I have regular weekly review periods.</td>
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<tr>
<td>Number</td>
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<tr>
<td>51</td>
<td>I do well on examinations requiring much factual information.</td>
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<td>52</td>
<td>Most of my instructors lecture too fast.</td>
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<td>53</td>
<td>I look for reasons behind the facts.</td>
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<td>54</td>
<td>I cram for exams.</td>
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<td>55</td>
<td>When I study something, I devise a system for recalling it later.</td>
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<td>56</td>
<td>I have trouble seeing the difference between apparently similar ideas.</td>
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<td>57</td>
<td>I always make a special effort to get all the details.</td>
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<td>58</td>
<td>I prepare a set of notes integrating the information from all sources in a course.</td>
</tr>
<tr>
<td>59</td>
<td>My memory is actually pretty poor.</td>
</tr>
<tr>
<td>60</td>
<td>I am usually able to design procedures for solving problems.</td>
</tr>
<tr>
<td>61</td>
<td>I do well on essay tests.</td>
</tr>
<tr>
<td>62</td>
<td>I frequently use the library.</td>
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**SCORING FOR ILP**

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<td>FACT RETENTION</td>
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Appendix F

MEMORY QUESTIONNAIRE

Directions:
Different people use their memory in different ways in their everyday lives. For example, some people make shopping lists, whereas others do not. Some people are good at remembering names, whereas others are not.

In this questionnaire, we would like you to tell us how you use your memory and how you feel about it. There are no right or wrong answers to these questions because people are different. Please take your time and answer each of these questions to the best of your ability.

Each question is followed by five choices. Draw a circle around the letter corresponding to your choice. Mark only one letter for each statement.

Some of the questions ask your opinion about memory-related statements; for example:

My memory will get worse as I get older.

a. agree strongly
b. agree
c. undecided
d. disagree
e. disagree strongly

In this example you could, of course, choose any one of the answers. If you agree strongly with the statement you would circle a. If you disagree strongly you would circle letter e. The b and d answers indicate less strong agreement or disagreement. The letter c answer gives you a middle choice, but don't use the c unless you really can't decide on any of the other responses.

Some of the questions ask how often you do certain things that may be related to your memory. For example:

Do you make a list of things to be accomplished during the day?

a. agree strongly
b. agree
c. undecided
d. disagree
e. disagree strongly

Again, you could choose any one of the answers. Choose the one that comes closest to what you usually do. Don't worry if the time estimate is not exact, or if there are some exceptions.

Keep these points in mind:

a) Answer every question, even if it doesn’t seem to apply to you very well.

b) Answer as honestly as you can what is true for you. Please do not mark something because it seems like the "right thing to say."
1. For most people, facts that are interesting are easier to remember than facts that are not.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

2. I am good at remembering names.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

3. Do you keep a list or otherwise not important dates, such as birthdays and anniversaries?  
   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

4. It is important to me to have a good memory.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

5. I get upset when I cannot remember something.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

6. When you are looking for something you have recently misplaced, do you try to retrace your steps in order to locate it?  
   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

7. I think a good memory is something of which to be proud.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

8. I find it harder to remember things when I am upset.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

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<tr>
<td>9. I am good at remembering birthdates.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>10. I can remember things as well as always.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>11. When you have not finished reading a book or magazine, do you somehow note the place where you have stopped?</td>
<td>a. never</td>
<td>b. rarely</td>
<td>c. sometimes</td>
<td>d. often</td>
<td>e. always</td>
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<td>12. I get anxious when I am asked to remember something.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>13. It bothers me when others notice my memory failures.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>14. I'm less efficient at remembering things now than I used to be.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>15. I have difficulty remembering things when I am anxious.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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<td>16. The older I get the harder it is to remember clearly.</td>
<td>a. agree strongly</td>
<td>b. agree</td>
<td>c. undecided</td>
<td>d. disagree</td>
<td>e. disagree strongly</td>
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17. Do you think about the day’s activities at the beginning of the day so you can remember what you are supposed to do?
   - a. never
   - b. rarely
   - c. sometimes
   - d. often
   - e. always

18. I am just as good at remembering as I ever was.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

19. I have no trouble keeping track of my appointments.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

20. For most people, it is easier to remember information they need to use immediately than information they will not use for a long time.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

21. Most people find it easier to remember directions to places they want or need to go than to places they know they will never be going.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

22. I am usually uneasy when I attempt a problem that requires me to use my memory.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

23. I feel jittery if I have to introduce someone I just met.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly

24. Having a better memory would be nice but it is not very important.
   - a. agree strongly
   - b. agree
   - c. undecided
   - d. disagree
   - e. disagree strongly
25. Do you post reminders of things you need to do in a prominent place, such as on bulletin boards or note boards?

   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

26. It doesn’t bother me when my memory fails.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

27. I am poor at remembering trivia.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

28. I am much worse now at remembering the content of news articles and broadcasts than I was 10 years ago.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

29. Do you routinely keep things in a familiar spot so you won’t forget them when you need to locate them?

   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

30. Compared to 10 years ago, I am much worse at remembering titles of books, films or plays.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

31. For most people it is easier to remember words they want to use than words they know they will never use.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

32. I remember my dreams much less now than 10 years ago.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly
33. I can’t expect to be good at remembering zip codes at my age.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

34. Most people find it easier to remember the names of people they especially dislike than people they hardly notice.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

35. I have little control over my memory ability.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

36. When you want to take something with you, do you leave it in an obvious, prominent place, such as putting your suitcase in front of the door?

a. never  
b. rarely  
c. sometimes  
d. often  
e. always

37. I think it is important to work at sustaining my memory abilities.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

38. I misplace things more now than when I was younger.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

39. As people get older they tend to forget where they put things more frequently.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

40. I work hard at trying to improve my memory.

a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly
41. Compared to 10 years ago, I now forget many more appointments. 

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

42. If I am put on the spot to remember names, I know I will have difficulty doing it.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

43. For most people, it is easier to remember the names of people they especially like than people that don’t make of an impression on them.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

44. Most people find it easier to remember words they understand than words that don’t mean very much to them.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

45. My memory for important events has improved over the last 10 years.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

46. I admire people who have good memories.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

47. My friends often notice my memory ability.

   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

48. When you try to remember people you have met, do you associate names and faces?

   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always
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<thead>
<tr>
<th>Statement</th>
<th>Response Options</th>
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<tbody>
<tr>
<td>49. I am good at remembering the order that events occurred.</td>
<td>a. agree strongly</td>
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<td>b. agree</td>
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<td>c. undecided</td>
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<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<td>50. For most people, words they have seen or heard before are easier to</td>
<td>a. agree strongly</td>
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<td>remember than words that are totally new to them.</td>
<td>b. agree</td>
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<td>c. undecided</td>
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<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<td>51. Familiar things are easier to remember than unfamiliar things.</td>
<td>a. agree strongly</td>
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<td>b. agree</td>
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<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<td>52. I am good at remembering conversations I have had.</td>
<td>a. agree strongly</td>
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<td>b. agree</td>
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<td>c. undecided</td>
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<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<td>53. I would feel on edge right now if I had to take a memory test or</td>
<td>a. agree strongly</td>
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<td>something similar.</td>
<td>b. agree</td>
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<td>c. undecided</td>
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<td></td>
<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<td>54. My memory for phone numbers will decline as I get older.</td>
<td>a. agree strongly</td>
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<td>b. agree</td>
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<td>c. undecided</td>
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<td>e. disagree strongly</td>
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<td>55. I often notice my friends’ memory ability.</td>
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<td>d. disagree</td>
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<td>e. disagree strongly</td>
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<tr>
<td>56. My memory for dates has greatly declined in the last 10 years.</td>
<td>a. agree strongly</td>
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<td>b. agree</td>
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<td>e. disagree strongly</td>
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57. When you have trouble remembering something, do you try to remember something similar in order to help you remember? 
   a. never 
   b. rarely 
   c. sometimes 
   d. often 
   e. always 

58. My memory for names has declined greatly in the last 10 years. 
   a. agree strongly 
   b. agree 
   c. undecided 
   d. disagree 
   e. disagree strongly 

59. I often forget who was with me at events I have attended. 
   a. agree strongly 
   b. agree 
   c. undecided 
   d. disagree 
   e. disagree strongly 

60. Do you consciously attempt to reconstruct the day's events in order to remember something? 
   a. never 
   b. rarely 
   c. sometimes 
   d. often 
   e. always 

61. As long as I exercise my memory it will not decline. 
   a. agree strongly 
   b. agree 
   c. undecided 
   d. disagree 
   e. disagree strongly 

62. I am good at remembering the places I have been. 
   a. agree strongly 
   b. agree 
   c. undecided 
   d. disagree 
   e. disagree strongly 

63. I know if I keep using my memory I will never lose it. 
   a. agree strongly 
   b. agree 
   c. undecided 
   d. disagree 
   e. disagree strongly 

64. Do you try to relate something you want to remember to something else hoping that this will increase the likelihood of your remembering later? 
   a. never 
   b. rarely 
   c. sometimes 
   d. often 
   e. always
65. It's important that I am very accurate when remembering names of people.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

66. When I am tense and uneasy at a social gathering, I cannot remember names very well.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

67. Do you try to concentrate hard on something you want to remember?
   a. never
   b. rarely
   c. sometimes
   d. often
   e. always

68. It's important that I am very accurate when remembering significant dates.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

69. It's up to me to keep my remembering abilities from deteriorating.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

70. When someone I don't know very well asks me to remember something, I get nervous.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

71. I have no trouble remembering where I have put things.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

72. It is easier for most people to remember things that are unrelated to each other than things that are related.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly
73. Even if I work on it, my memory ability will go downhill.

74. Most people find it easier to remember concrete things than abstract things.

75. Do you make mental images or pictures to help you remember?

76. I know of someone in my family whose memory improved significantly in old age.

77. I am good at remembering things like recipes.

78. I get anxious when I have to do something I haven’t done for a long time.

79. It bothers me when I forget an appointment.

80. Most people find it easier to remember things that happen to them than things that happen to others.
81. Do you mentally repeat something you are trying to remember?  
   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

82. My memory has improved greatly in the last 10 years.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

83. I like to remember things on my own, without relying on other people to remind me.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

84. I get tense and anxious when I feel my memory is not as good as other people's.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

85. Do you ask other people to remind you of something?  
   a. never  
   b. rarely  
   c. sometimes  
   d. often  
   e. always

86. I'm highly motivated to remember new things I learn.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

87. I do not get flustered when I am put on the spot to remember new things.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly

88. I am good at remembering titles of books, films, or plays.  
   a. agree strongly  
   b. agree  
   c. undecided  
   d. disagree  
   e. disagree strongly
89. My memory has declined greatly in the last 10 years.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

90. For most people it is easier to remember things in which they are most interested than things in which they are less interested.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

91. I have no trouble remembering lyrics of songs.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

92. My memory will get better as I get older.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

93. It is easier for most people to remember bizarre things than usual things.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

94. Do you write yourself reminder notes?
   a. never
   b. rarely
   c. sometimes
   d. often
   e. always

95. I am good at remembering names of musical selections.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly

96. Most people find it easier to remember visual things than verbal things.
   a. agree strongly
   b. agree
   c. undecided
   d. disagree
   e. disagree strongly
97. After I have read a book I have no difficulty remembering factual information from it.

98. Do you write appointments on a calendar to help you remember them?

99. I would feel very anxious if I visited a new place and had to remember how to find my way back.

100. I am good at remembering the content of news articles and broadcasts.

101. No matter how hard a person works on his memory, it cannot be improved very much.

102. If I were to work on my memory I could improve it.

103. It gives me great satisfaction to remember things I thought I had forgotten.

104. Remembering the plots of stories and novels is easy for me.
105. I am usually able to remember exactly where I read or heard a specific thing.
a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

106. I think a good memory comes mostly from working at it.
a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

107. Most people find it easier to remember unorganized things than organized things.
a. agree strongly  
b. agree  
c. undecided  
d. disagree  
e. disagree strongly

108. Do you write shopping lists?
a. never  
b. rarely  
c. sometimes  
d. often  
e. always
### SCORING FOR THE MIA

**Scale:**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Item Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy (+ = high use)</td>
<td>3, 6, 11, 17, 25, 29, 36, 48, 57, 60, 64, 67, 75, 81, 85, 94, 98, 108</td>
</tr>
<tr>
<td>Task (+ = high knowledge)</td>
<td>1r, 20r, 21r, 31r, 34r, 43r, 44r, 50r, 51r, 72, 74r, 80r, 90r, 93r, 96r, 107</td>
</tr>
<tr>
<td>Capacity (+ = high capacity)</td>
<td>2r, 9r, 19r, 27, 49r, 52r, 59, 62r, 71r, 77r, 88r, 91r, 95r, 97r, 100r, 104r, 105r</td>
</tr>
<tr>
<td>Change (+ = stability)</td>
<td>10r, 14, 16, 18r, 28, 30, 32, 38, 39, 41, 45r, 54, 56, 58, 76r, 82r, 89, 92r</td>
</tr>
<tr>
<td>Anxiety (+ = high knowledge)</td>
<td>5r, 8r, 12r, 15r, 22r, 23r, 42r, 53r, 66r, 70r, 78r, 84r, 87, 99r</td>
</tr>
<tr>
<td>Achievement (+ = high achievement)</td>
<td>4r, 7r, 13r, 24, 26, 37r, 40r, 46r, 47r, 55r, 65r, 68r, 79r, 83r, 86r, 103r</td>
</tr>
<tr>
<td>Locus (+ = internal locus)</td>
<td>33, 35, 61r, 63r, 69r, 73, 101, 102r, 106r</td>
</tr>
</tbody>
</table>

**NOTE:** Each item is scored on a 5-point Likert scale. Items which are reverse scored are followed by an "r".
Appendix G

Reading Span Test
Data Sheet
Experimenter_______

CIRCLE CORRECT RESPONES:

Practice Trials
Set 1 1. forefinger  2. down
Set 2 1. police    2. path
Set 3 1. dinner    2. pocket
Set 4 1. garden    2. surprise
Set 5 1. place     2. sleeping

Test: 2 cards:
Set 1 1. away      2. album
Set 2 1. look      2. lake
Set 3 1. bitter    2. train
Set 4 1. oven      2. roof
Set 5 1. dry       2. interest
TOTAL SETS:

3 cards:
Set 1 1. shaft      2. gets      3. returned
Set 2 1. stairs     2. ice       3. shock
Set 3 1. sailing    2. nature    3. parked
Set 4 1. long      2. metals    3. dog
Set 5 1. war       2. built     3. felt
TOTAL SETS:

4 cards:
Set 1 1. quarter   2. lock      3. coast    4. book
Set 2 1. smell     2. tower     3. bet      4. fish
Set 3 1. post      2. yard      3. skins    4. mind
Set 4 1. fight     2. table     3. hill     4. music
Set 5 1. window    2. anger     3. hour     4. snore
TOTAL SETS:

5 cards:
Set 1 1. flood     2. saw       3. pillow   4. hall    5. pinch
Set 2 1. buckled   2. cities    3. valley   4. wasps   5. fright
Set 3 1. living    2. block     3. cuffs    4. outside 5. late
Set 4 1. light     2. jokes     3. farmers  4. worry   5. desk
Set 5 1. oil       2. soiled    3. possible 4. ponds   5. leave
TOTAL SETS:

TOTALS:
2 cards _______
3 cards _______
4 cards _______
5 cards _______
SCORE: __________

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READING SPAN TEST

Read to Subject:
"The following test involves reading several sentences and then recalling the last word of each sentence. I will show you cards with 1 sentence on each, as soon I show you the card read it out loud. When I show you a blank card, you are to repeat back to me as many of the last words as you can remember. You can say these in any order, except not the last sentence first. As the test progresses there will be more and more sentences per set. We will start with some trial sessions for practice. Do you have any questions?"

Then starting with the trial cards, present the first card flat on the table in front the subject. As soon as it has been read, place next card on top, when this has been read cover it with a blank card. Pause and wait for subject to say the last 2 words (reminder that last word from last sentence cannot be said first). Write down their responses. Reread directions if necessary. Repeat for 3 trials of 2 sentences each.

When procedure is mastered by the subject, go on to the 5 sets of test sentences. (There are 5 of each of 2, 3, 4, 5, & 6 sentences sets.) STOP testing when the subject has missed 3 sets of sentence groups.
I turned my memories over at random like pictures in a photograph album.

The girl hesitated for a moment to taste the onions because her husband hated the smell.

There are days when the city where I live wakes in the morning with a strange look.

We boys wanted to warn them but we backed down when it came to the pinch.

He stood there at the edge of the crowd while they were singing, and he looked bitter.

When at last his eyes opened, there was no gleam of triumph, no shade of anger.

The taxi turned up Michigan Avenue where they had a clear view of the lake.

She stops in front of a newspaper box, bending to look in through the glass window.

He comes into the kitchen as she’s sliding the casserole dish into the oven.

But at last, she has frightened her aunt, who is scuttling down the hall.

The room was dark and he had to get to the front of the train.

Then he traced the veins and their branches between his thumb and forefinger.

The sky was absolutely clear of clouds, the air cool, crisp, and dry.

He fell asleep, his right hand clutched around the ancient teddy bear ear under his pillow.

There was one window, painted shut, that opened on another section of the roof.

They had been scared but gradually got over the worst of their fright.

I wondered if I could remember that license number and report it to the police.
The dogs didn't move but looked at us with the meanest eyes I ever saw.

She didn't appear to have been scared at all, but regarded him with interest.

The firemen had to put on special clothes and masks because of the wasps.

A festive atmosphere settled on the camp when they began to prepare dinner.

On the higher ground he could avoid the threats of a flash flood.

Some time ago my mother became ill and then the years slipped away.

She began to roll down the sleeves of her blouse and button the cuffs.

Her sister did not like the idea of working to earn a living.

When they returned to the dining room they were only a few minutes late.

He looked behind him, quickly said goodbye to the guests, and stalked down the path.

He flicked the reins, and the mules began the gradual descent into the valley.

It imparted the illusion of having triumphed over the elements, over man and nature.

He carefully regarded the older woman sitting on the other side of the desk.

She sat frozen and motionless, her face neither revealing her thoughts nor her surprise.

It had already cost the store a loss of referral business from other cities.

We have delayed action for twenty-four hours which is half a day too long.

On joining the press of pedestrians on the street he transferred the keys to a pocket.
He hailed a taxi which took him quickly to where his car was parked.

With the aid of a street map he easily located the address he had jotted down.

It was a well cared for residence with a double garage and spacious garden.

She said something about spending a quiet evening after returning from a walk around the block.

He seemed frail again tonight, the paleness of three days earlier had returned.

He was careful not to exceed posted speed limits as he approached a flashing light.

When you believe in someone, don’t be in a rush to change your mind.

It had been a relief to her to hear that she was required urgently outside.

Maybe I should tell you that I have just had something of a shock.

It was obvious nothing would happen tonight, so he turned down the corridor to leave.

The meeting was breaking up, only one person seemed amused at what had taken place.

As one set of clamps held and the other failed, the car twisted and buckled.

Screaming, clutching wildly at each other, the passengers slid toward the shaft.

It was important that he get clear of New Orleans as quickly as possible.

When you are with her you sit wondering what is under all that solid ice.

He saw himself in the mirror and realized his suit was rumpled and soiled.

When a work force is unlimited, one mistake is all a man gets.
He put in several hours of work a week at the hospital and his private practice.

Before he realized what was happening, he was responding with all the love he felt.

He was enchanted by the child, and was quick to smile at her jokes.

She cast her eyes to heaven, praying she would not break her neck on the stairs.

The beauties of life shouldn’t be hoarded, but surrendered joyfully while still in bloom.

Running on natural surfaces help reduce the chances of foot and knee injuries to your dog.

Most towns in the lake region provide public beaches, boat launches and watercraft rentals.

When the fish aren’t biting, the lakes offer fine swimming, waterskiing, and sailing.

Park tours include canoe voyages, nature hikes, boat cruises, and visits to beaver ponds.

When it comes to planning an unforgettable coast to coast vacation, we wrote the book.

Farming is still important in China, and two thirds of the people are farmers.

Many people in Vietnam and its neighboring countries are very poor because of years of war.

Canadians are proud of their beautiful lakes, mountains, and the cool, clean air of their forests.

The United States has large resources of oil, gas, coal, and many metals.

Gold and other metals are mined in Mexico, but the most important industry is oil.

In Africa cattle are kept for their meat, as well as for their hides and skins.

Once hunted, many lions, elephants, zebras, and rhinos now live on large game reserves.
In uncrowded Australia, most people live in cities along the cooler southeast coast.

In the islands of Polynesia, many factory workers process meat, butter, cheese, and milk.

There are many big ports on the Baltic Sea where ships are built.

Spain's warm climate and golden sands attract thousands of tourists to its coastal resorts.

Vienna, the capital of Switzerland, is famous for its famous composers of music.

Barges travel down the Rhine in Germany past lovely towns, green fields, and castles.

A spectacular view of Paris can be seen from the higher levels of the Eiffel tower.

I stood panting, egging them on, taunting them to come on and fight.

She slammed the door after me and I heard the key turn in the lock.

After the rain had stopped, my father came out of the woods leading a pack horse.

The boy blubbering on the floor, in the dim enclosure, looked like a snarled, smothering fish.

His position blocked most of the light, so he would have to work in the shadow.

Neither the master nor the overseer had heard or seen anything unusual in the quarter.

A long patience was his strength, and he waited, neither moving nor sleeping.

He was a hard, unsympathetic old man, the aunt decided in her mind.

The occupants of the carriage were a small girl, and a smaller girl, and a boy.

Whoever it was who had made the wager was likely to lose his bet.
The exhausted men bent to the oars, and the ships crawled over the fire blue water.

He glimpsed something moving across the valley, on the slope of a hill.

Then I remembered some of the great times we'd had and I began to laugh.

When we reached the house, she stopped and looked at the house and yard.

I followed him up the hill where the yellow poplars and pines grow.

He pulled a cigar from his inside coat pocket and struck a match under the table.

Emily Dickinson wrote her poems secretly on scraps of paper, some she copied into little booklets.

He was a man of wonderful patience and politeness, but deaf as a post.

The light that came through their roof of leaves was trembling like light through water.

For some time the wind had been bringing her great blasts of radio music.

In the grass she saw a broken doll, somebody's garter, many weathered corncobs, and beer cans.

She peeked in the doorway but all she saw was his socks and heard him snore.

The screen door was dilapidated and instead of a doorknob there was a spool to turn.

There were two alarm clocks, one on its side, and each asserted a different hour.

I never said a word to your father and mother, I didn't want them to worry.
Page 97 omitted in numbering.
Appendix H

READING INSTRUCTIONS

This is the final segment of this study. During the next hour you will be reading 2 sections of an introductory Psychology text.

SHALLOW PROCESSING GROUP INSTRUCTIONS:
"Please read the following texts. You will have 20 minutes to read each text until you are confident that you understand the material. When it is time to start studying the second text I will tell you to start on text #2. Your task is to determine if these are clearly written passages that could be understood by the average college freshman."

DEEP PROCESSING GROUP INSTRUCTIONS:
"Please read the following texts. You will have 20 minutes to read each text until you are confident that you understand the material. When it is time to start studying the second text I will tell you to start on text #2. Your task will be to teach another student what the main points of the passages are. This student will be tested for what he has learned from you. In order for us to have a written record, we will ask you to prepare a summary of the information you will be presenting to your student. The texts will not be available once you have finished reading it."

BOTH GROUPS:
"Start reading text #1, it is 7 pages long. Do not continue to text #2 until told to do so."

20 minutes later: "Please stop reading text #1, and start reading text #2."

20 minutes later: "Please stop reading and close the booklet. I will now distribute a test over the material in text #1 with a data sheet like the ones you completed on your weekly tests. Please indicate how many answers you expect to answer correctly. Then turn over the test, answer each question followed by making the judgement related to that question on the data sheet. Continue with all 7 questions, turn over the data sheet and answer the question on the back. When you are done place the data sheet and test face down on your desk."

When everyone is done: "I will now distribute a test over the material in text #2 with a data sheet like you previously completed. Please follow the same instructions for this test."
Appendix I

SAMPLE MULTIPLE CHOICE QUESTIONS BY TYPE

1. Higher-than-recall and Abstract:

   A student cannot make it as a scholar and decides to become a good athlete illustrates _______________.
   a] displacement       c] reaction formation
   b] projection         d] sublimation

2. Higher-than-recall and Concrete:

   Intellectualization is a valuable defense mechanism for ________________.
   a] artists            c] plumbers
   b] teachers           d] doctors

3. Recall and Abstract:

   Defensive coping is a form of ________________.
   a] confrontation      c] aggression
   b] compromise         d] self-deception

4. Recall and Concrete:

   Soldiers who break down in the field often cope with their situation by using the technique of ____________.
   a] withdrawal         c] aggression
   b] intellectualization d] repression
Appendix J

DEBRIEFING SCRIPT

Thank you for your participation in this study. I will take a few minutes to explain the purpose of this study and what we expect to find from this research.

The knowledge of one's own memory and memory functioning is called metamemory. It has been suggested that this knowledge is what determines the allocation of study time and decisions related to when one is prepared to take a test. When you predicted your test scores we were measuring your metamemory. Further research has shown that students may use their past grade history to base predictions on, rather than the knowledge they feel they have for the test at hand, so making judgments of each test item provides a more specific measure of metamemory. The postdiction, or statement following each test of the number you thought you answered correctly, is another aspect of metamemory.

We were interested in comparing actual classroom test metamemory measures with laboratory situations, therefore the two segments of the study. In previous studies it has been observed that there is a great deal of variability among students in making accurate predictions and judgments. The inventories and questionnaires that you completed during the first laboratory segment included measures of metamemory beliefs and knowledge, reading span, and other measures that may indicate which students use metamemory skills more effectively.

Being able to accurately assess one's own memory before a test situation is a valuable skill for students to possess. The results of this study will further our understanding of who uses this information most effectively and aid educators in targeting students that may benefit from metamemory training.

If you would like to have a summary of the results of this study when available, please write your name and address on this form. (Circulate form with space for name, street address, city, state, zipcode)

Are there any questions regarding your participation in this study? Thank you.

REMINDER: Please don't discuss the details of this section of the study with any other students, as there are still many students to participate and their knowledge of the tests would seriously alter our results.