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CHAPTER 1

Rationale

An instructional system must be designed in accord with the principles of human information processing in order to reach optimal effectiveness and efficiency (Gagné, 1977). Many researchers and producers of instructional materials have written books and manuals outlining how research results might be put into practice (Briggs, 1977; Kemp, 1977; Dick & Carey, 1978). However, there is almost no specific information available for instructional designers regarding how to translate a given message into an appropriate medium (Levie & Dickie, 1973; Mayer, Note 1; Bernard, Note 2). This study investigates both visual and auditory processing variables, and examines the utility of imagery theory and the dual-coding hypothesis (Paivio, 1971) as a source of specific guidelines for the development and production of instructional materials.

Imagery and Dual-Coding

According to Paivio's dual-coding hypothesis (1969, 1971, 1978a, 1978b), cognitive processes are mediated by a linguistic and a nonverbal (including pictorial) coding scheme. These two systems are independent but interconnected. A conceptual referent can be stored as an imaginal (pictorial) and/or a verbal (linguistic) representation depending upon its intrinsic characteristics. When stored in both systems, the referent's memorability is increased (Paivio, 1978a). Paivio and Csapo (1973) further maintained that the memorability of the imagery code is substantially higher than that of the verbal code. Indeed, the

vivid nature of imagery in mental processing has asserted itself since ancient times, from Simonides' place-image techniques (Yates, 1966) to the superior effects of mnemonic imagery instruction in modern classroom language learning (Raugh & Atkinson, 1975).

Literature in the area of instructional design has provided only very general guidelines for the selection of media for instruction in the form of decision charts (e.g., Anderson, 1976; Kemp, 1977; Romizowski, 1974). Dick and Carey (1978) have suggested several factors to consider in media selection. These begin with identifying the general characteristics and entry behaviors of the target population, and determining the type of learning involved in the instructional objectives. However, objectives have been found by the author to be too broad to be helpful (Mayer, Note 1). Rather, the specific criteria, behavior, and conditions of an objective are more adequate for directing a general decision regarding the appropriate type of media.

Other factors which must be taken into account in media selection are the availability of the media, the ability of the designer to design or develop the selected materials, time limitations (for production and/or presentation), and cost effectiveness (Dick & Carey, 1978; Mayer, Note 1). These are technical constraints which must be dealt with following a thorough analysis of the topic content. Such an analysis enables the designer to identify the modes of presentation which are essential for effective learning of the overall theme of the instructional unit.

Once the medium has been selected, the designer presently must act only as a technical producer, relying on common sense and experience for orchestrating and presenting the individual ideas within the unit (Bernard, Note 2). The research literature does not answer fundamental questions regarding how audio and visual channels can work together to convey the intended message. Attention-getting visuals often distract from rather than support the information to be learned. Through this study's identification and analysis of crucial visual learning variables, it is hoped that more concrete recommendations can be made to assist instructional designers in creating more effective instructional products. The following section discusses those factors which have been implemented in learning studies on imagery, and offers several unique considerations within the imagery context which may prove particularly useful in designing instruction.

Discrete versus analog information processing. Paivio claimed that the imagery coding system is mainly analog-based while the verbal coding system is mainly discrete-based, or digital (1978b, pp. 540-541). Analog is defined here as capturing information in a holistic manner, recapitulating as a whole. Digital is defined as a string-like, sequential presentation of information (Kolers & Smythe, 1979; Pask, 1972). However, both the imagery and the linguistic systems involve some analog and some discrete properties as a consequence of system interaction (Kolers & Smythe, 1979; Paivio, 1978b, 1978c). The factors are therefore best understood on a highly skewed bimodal continuum with some overlap at the center. Since visual perception is viewed

as a parallel processing system, and auditory perception is viewed as sequentially organized (Paivio, 1971, p. 33), one may conclude that the basic difference between the two modes of presentation (visual and auditory) should give the instructional designer some clue regarding the selection of presentation modes for different units of information. Indeed, by virtue of the temporal nature of speech, it is logical to assume that information presented in the auditory mode is sequentially organized. Visual information, however, is spatially processed, and is scanned differently. An image is generally processed faster than verbal information either when imaginal information is supplied or when it is subject-generated (Paivio, 1971). One must note, however, that the imagery system is capable of sequential processing if its elements are linked to sequential operations involving the verbal system. Similarly, the verbal system is capable of functioning in a parallel manner, but cannot operate spatially (Paivio, 1971). This may imply that in many circumstances, information presented in the auditory mode should be supplemented by visual information, preferably iconic (pictorial). In other words, spatial organizers may assist sequential retention. Because of the general superiority of the imaginal system over the verbal in "verbal" learning, the use of imagery via the visual mode of presentation should enhance learning and faciliate performance in free recall and recognition.

Content familiarity. Familiarity with a certain subject matter area aids the learner in acquiring new material in that area. Schmid

(Note 3) has provided evidence that prior knowledge in a certain subject area strongly affects the quantity learned from a related passage. Learners familiar with a subject were purportedly able to learn more new information in that area because the new information was integrated into an existing cognitive structure (Ausubel, 1968). Such a structure does not exist in learners unfamiliar with the subject matter. Bransford and Johnson (1972), in studying the relationship between knowledge and comprehension, found that comprehension which involves the retrieval of prior knowledge enables semantic recall. Clearly, prior knowledge should be taken into consideration in planning instruction both for content and procedure.

The factor of content familiarity (or prior knowledge) has been taken into account in the instructional design literature only for the purpose of identifying learners' characteristics and entry behaviors (Dick & Carey, 1978; Kemp, 1977), but not as a means for better decision making in the selection of presentation modes for different ideas or sections within the instructional unit itself. The individual's or group's familiarity with specified content may influence what mode of presentation should be used, and has been considered in the present study. A learner's confidence in the correctness of a given response has been found to be directly related to the amount of knowledge acquired (Kulhavy, 1977). It is suspected that overall prior knowledge of a body of information would provide similar effects. Thus, subjects with prior knowledge would not only retain more information than non-familiar subjects, but would also be more

confident about their responses.

Concreteness/abstractness. This factor is defined as the degree to which a stimulus can evoke an image or a mental picture. Content familiarity and content abstractness are related in that a learner who is familiar with the subject matter area will be able to evoke images of stimuli more easily than one who is unfamiliar with them. For the learner who is familiar with the content, the concept may be considered concrete, thus easily imaginal, while for the unfamiliar, the same concept may be abstract, thus difficult to image. Since concrete information is more easily retained than abstract information (Paivio, 1971, 1978c), information considered by the present group of subjects to be familiar should be recalled more easily than that which is identified as nonfamiliar or more abstract.

The concreteness/abstractness concept was referred to by Paivio (1971) as possibly relating to the specificity/generality level of terms. Concrete tasks may demand identification of specific features of the stimuli and require particular responses. Abstract tasks may be more complex and usually refer to general features. Abstractness can, however, activate specifics, as concreteness can activate generalities. Anderson, Pichert, Goetz, Schallert, Stevens, and Trollip (1976) found that in sentence recall, people store specific instances rather than general meanings. Therefore, the instructional designer should strive to make abstract or unfamiliar concepts more concrete in order to facilitate learning. Results of a study by Paivio (1965) have shown a high correlation between imagery and concreteness. Thus,

imagery should be used as a mnemonic aid by providing visuals as exemplars of abstract information presented verbally. The above is suggested as a factor to be considered in the preparation of more effective instructional materials.

One problem with the concreteness or familiarity factors is that they vary from individual to individual. Instruction is usually directed toward a somewhat homogeneous group which, when taken as a whole, may still benefit from the above considerations. Individualized instruction would offer a utopian environment for the evaluation and implementation of such instruction, but is not yet a practical expectation.

Hierarchical organization. The hierarchical relationships among the different information units presented in a topic should always be taken into consideration in the development of instructional materials (Gagné, 1977). A hierarchical relationship maps out the organization of superordinate and subordinate concepts, and graphically represents both their semantic and sequential order. Subordinates must be learned as part of, and therefore before, the appropriate superordinate. At the level of information processing, it is suspected that the hierarchical relationship of concepts may be factorially related to the abstractness and familiarity factors cited earlier. That is, superordinate concepts tend to be more abstract or less specific, depending upon the learner's familiarity, and thus more difficult to image. Ease of retention is similarly affected.

Cognitive level of information: Bloom developed a taxonomy for the cognitive domain which provides a hierarchy of mental activities from simple memorization of simple stimulus-response links (facts, words) to complex evaluation using abstract criteria (Bloom, 1956). For example, in order to learn facts, one merely needs to be able to recall them from memory. This is referred to by Bloom as "knowledge". "Comprehension" is the next level, which requires the ability to understand the meaning of information or to restate the information in one's own terms. The next level in the hierarchy is the "application" stage which requires the ability to generalize and discriminate, or to apply information to new situations using principles, procedures, and rules (Kemp, 1977). In the preparation of instructional materials the instructional designer is always advised to aim instruction toward the highest level possible. Given that the content of a unit of instruction has been determined, it may be useful to first identify at what taxonomic level pieces of information fall, and assess them for appropriate media dissemination. For example, a procedure tends to be more abstract and sequential than facts, and would therefore be presented using verbal or flowchart visuals with audio explanations.

In this thesis, all of these factors were taken into account in the process of selecting and producing the instructional materials.

Rationale for the Selection of Media

Subjects in the experiment were tested on a topic in accountancy. Instruction of this subject is usually performed verbally,

i.e., in a lecture format, supported at times by some visuals (slides) which are absolutely essential for comprehension of the material (Lowenfeld, Note 4).

A sound-slide presentation was selected as the medium to be used since it provides both a verbal and a pictorial mode of presentation. An audiovisual presentation caters both to the requirement of the subject matter to be instructed and to the testing of hypotheses proposed in this thesis in relation to Paivio's concept of imagery, and the dual-coding hypothesis. A sound-slide presentation also provides the degree of control needed, both to create well designed and consistently well presented instruction, and to be able to cover idea units in their appropriate form and subsequently test them for recall and recognition. The topic "Approaches to the preparation of consolidated financial statements" consists of factual, comprehension, and application level information. Visuals in the form of slides are ideal for providing pictorial information and concrete examples of abstract concepts and rules that were presented. It is the opinion of the author and the subject matter expert that the chosen media provided the best possible approach for presenting the subject matter, while also enabling the test of all the different factors suggested in the hypotheses in this thesis.

Statement of the Problem

The imagery factors outlined above and the sound-slide media should enable a direct test of the dual coding hypothesis within an instructional environment. The information processing literature, and dual-coding in particular, suggest that a given unit of information

will be best retained if its mode of presentation matches its inherent processing characteristics. Those characteristics have been broadly defined as analog and digital. Associated descriptive and operational labels may include continua of abstractness and familiarity, hierarchical level, and position in Bloom's taxonomy of cognitive complexity. Thus, the task before us was to generate a unit of instruction with well-defined idea units using these factors in a systematic design. The dual-coding hypothesis makes precise predictions regarding the memorability of various types of information, and the post-tests have subjected them to empirical examination using both recall and recognition instruments.

The validity and reliability of this investigation relied almost entirely on the theoretical quality of the materials. It has been hypothesized that visual information is retrieved more readily than auditory information because the former benefits from the use of a dual code (Paivio, 1975, in press). However, pictorial superiority can be eliminated or reduced if subjects generate images to auditory (verbal) information by themselves (Paivio, Note 9). Such idiosyncratic encoding would be influenced both by the learner's familiarity with the idea or subject matter and the time allotted him or her to create an effective image. The experimental design manipulated the familiarity factor so that these differences could be directly observed. The fast pace of the sound-slide production would likely restrict or eliminate time for the creation and processing of conflicting imagerial information, in that visual information was constantly present,

and audio virtually ongoing (save pauses as found in natural discourse). In a sound-slide presentation containing hundreds of units of information, the visual superiority prediction may be applied on a unit-by-unit basis. However, unlike typical verbal learning studies where units of information are generally discrete (regardless of their analog or digital characteristics), the sound-slide presentation conveyed a cohesive body of information with multiple levels of interaction. Any given abstract unit may become associated with its more concrete exemplar via prior or subsequent content. It is, in fact, the objective of the instructional designer to generate this cooperative complex which enables the leaner to have greater flexibility in discrimination, generalization, rule using, and transfer. Therefore, the principal research question was whether the dual-coding hypothesis could be systematically applied to media design with tangible results beyond the use of the systematic approach to instruction.

The instructional presentation was produced using both thorough knowledge of applying dual-coding principles, and the systems approach. No attempt was made to compare what are hypothesized to be conceptually superior and inferior products. Rather, all comparisons save one were within-subject factors dealing with content modality and test interval. Because dual-coding relates directly with information abstractness, and abstractness varies among individuals, groups of learners from several levels of content familiarity were employed as a between-subject factor. However, this factor is far more relevant in its analysis of

interaction between group performances. The learners familiar with the unit content were expected to find it easier to organize or chunk units of information into already existing schemata. It was therefore predicted that the overall quantity of ideas recalled by the familiar subjects would be significantly larger than the amount recalled by the subjects with no prior knowledge. Furthermore, subjects with high, and perhaps medium, prior knowledge, were expected to recall more information presented auditorily than subjects from the unfamiliar group. Visual aids, on the other hand, were expected to demonstrate greater differential effectiveness for the low familiarity group. Thus, the dual-coding hypthesis would advise the design of different materials for learners of varying levels of familiarity. Concretization of information via the visual mode of presentation should enlarge the overall amount of units of information recalled by the unfamiliar group. As for the groups with high or medium prior knowledge, it was expected that information presented visually would be retained better, especially after a one-week delay, than information presented auditorily (as should the unfamiliar group). Subjects with greater prior knowledge should also benefit more from information presented in both modalities, as they would not suffer from channel overload, and would be able to integrate the two units of information more readily. They would also be expected to be more confident about the correctness of their responses.

Finally, a recognition task asked learners to identify whether a stated idea had been presented or not, and also asked them in which

modality it had been presented. If dual-coding accounts for memory storage, the modality of presentation should have remained attached to the idea unit, at least over a short time (e.g., an hour). Recall of modality would be influenced by the degree to which learners had to recode the information. Unfamiliar subjects were thus expected to perform less well on this task than accounting students.

CHAPTER 2

Review of the Literature

The issue of developing effective instruction has been the concern of a great many modern-day educators. Briggs (1977), Bruner (1966), Dick and Carey (1978), Gagné (1977), Kemp (1977), Skinner (1968) and many others have written numerous books and articles devoted to the essential details of planning, designing and implementing effective instructional programs. In an attempt to reach optimal effectiveness and efficiency, researchers have engaged in basic research in learning theory, perception and memory (Gagné, 1977). In addition, as a result of tremendous technological development, media techniques have improved and are used more frequently as tools and aids in the presentation of instruction. Research in the area of media application and its use in the instructional process has thus been a "hot issue" in recent years (Clark, 1978; Levie & Dickie, 1973; Salomon, 1979; Severin, 1967).

Due to the vast number of studies associated with both learning theory and media technology, the focus of this literature review has been narrowed to the link between these two areas in regard to the effects of imaginal and auditory perception on memory. The first section deals with literature in learning theory regarding Paivio's dual-coding hypothesis and imagery. The second section discusses media literature relevant to dual-coding. It specifically addresses studies concerned with the effectiveness of multiple versus single channel communication, redundancy in information presentation, channel capacity,

and the possibility of information presented in one channel interfering with information presented in another. Finally, the integration of the two sections is attempted. The relationship between research in learning theory and the media literature is analysed in terms of its importance for instructional designers.

Imagery and Dual-Coding

The term imagery is used by Paivio (1971) to refer to nonverbal memory representations of concrete objects and events, or "pictures" in the mind of an individual. Cooper and Shepard (1973) have further asserted that a mental image is an internal representation which can be used as a basis for further information processing. The mental image can be used by the individual as a mnemonic aid for generating a verbal (or a nonverbal) description of the imaged object or event.

In reference to dual coding, Paivio (1978a) claimed that we have two memory traces, verbal and imaginal. Because these two systems are interconnected, they can work together to enhance the probability of retrieval of information initially encoded in one or the other. Visual imagery is often aroused by verbal (or linguistic) cues, while an imaged scenario can be translated into a linguistic description (Paivio, 1978a, 1978b). Imagery theorists further argue that the memory codes used for verbal and visual information are different. The image system organizes information spatially, while verbal information is organized sequentially (Kosslyn & Pomeranz, 1977; Paivio, 1971, 1978b).

One source of support for this viewpoint has been provided by physiological data concerning hemispheric asymmetry in information

processing. For the vast majority of people, the right hemisphere is claimed to be better adapted for nonverbal, spatial tasks and the left hemisphere specializes in linguistic and analytic tasks (Anderson & Bower, 1973; Corballis, 1980). However, all tasks are processed to some extent by both hemispheres such that learning in one mode can be supported by learning in another mode. (Further support for this view is provided in the section about multiple channel communication discussed below.) Thus, learning which incorporates both verbal information and visual imagery contexts enhances long-term retention and recall (Hand, Note 5; Paivio, 1971).

In testing a dual-coding explanation of information processing in a typical learning environment, Pellegrino, Siegel and Dhawan (1975) predicted that retention would be facilitated because of the creation of multiple sources and cues for item retrieval. Evidence for this assertion was provided by Severin (1967a). He conducted a study in which different groups of subjects were assigned different treatment conditions testing for the effectiveness of relevant pictures in multi-modal learning. One group was presented with an audio presentation with relevant pictures. A second group received an audio presentation with relevant printed materials. A third group was presented with printed material only, while a fourth group was given only the auditory presentation. A fifth group received audio information with unrelated pictures. Severin found that the group which received the audio with related picture treatment performed significantly better than any of the other groups. One of the important conclusions from Severin's study was that by providing both verbal and pictorial cues,

memorability of presented materials increased. Further support for the dual-coding hypothesis and its implications for learning was provided by Salomon (1979). The comprehension of textual materials is assumed by Salomon to be aided by the reader's (or listener's) generation of mental images or imagery-like meanings. Thus, the learning of verbal information can and should be facilitated by providing pictures to accompany the materials, or at least by providing the learners with imagery instructions (Salomon, 1979, p. 70).

One should note, however, that the effect of imagery may differ from one person to another. Some people are known to be better imagers than others, while some perform higher on verbal tasks (Berger & Gaunitz, 1979; McKelvie & Demers, 1979). Paivio (1971) constructed the Individual Differences Questionnaire (IDQ) to identify verbal versus imaginal "thinking habits" of different individuals. A factor analysis based on data from more than 700 subjects was conducted on the questionnaire. Paivio found that a two-factor solution revealed clear imagery and verbal factors. Scores based on the two-factor solution correlated very highly (over .9) with imagery and verbal scores based on the complete original list of statements in the quesionnaire (Paivio, Note 6). Scores based on the two-factor solution were therefore seen as valid indicators for an individual's tendencies toward a verbal, imagerial or split memory code. It is suspected that retention should be directly related to the modality in which information is presented and the individual's tendencies. IDQ scores may provide the link for empirical testing.

Abstractness of instructional materials. The level of abstractness/concreteness of instructional materials has been examined as a significant factor in the retention of information (Elliott, 1973; Newell & Olejnik, Note 7; Paivio, 1965, 1969, 1978; Schmid & Kulhavy, in press). Paivio (1969) claimed that while both concrete and abstract words can be coded in memory verbally, concrete words can also be coded imagerially. Paivio, Yuille and Madigan (1968) obtained normative data for the concreteness, imagery and meaningfulness attributes for 925 nouns. Abstractness/concreteness was rated on a seven-point scale. Each word was also rated on a seven-point Low Imagery/High Imagery scale. Paivio et al. obtained correlations of .56 between concreteness and meaningfulness, .72 between imagery and meaningfulness, and .94 between concreteness and imagery. These data further confirmed results of high correlation between imagery and concreteness obtained in an initial study by Paivio in 1965. Further evidence was provided by Paivio and Csapo (1969), who also argued for the importance of imagery and its relation to concreteness and meaningfulness. Subjects in the Paivio and Csapo experiment were presented with lists of pictures, concrete nouns or abstract nouns. In order to prevent verbal coding of pictures, items were presented at a very fast rate of 5.3 items per second. Subjects' free recall was tested following the fast-rate presentation and also following a slower presentation of two items per second. The results showed that free recall was essentially the same for the three types of items

at the fast rate. However, at the slow rate, the amount of pictures recalled exceeded that of concrete words, and more concrete than abstract words were recalled. Presumably, the differences in the slow rate condition were due to the fact that enough time was available for the arousal of images to concrete words. More recently, Kerst and Howard (1977) questioned the possibility of a different reaction time in comparison to items along concrete versus abstract dimensions. Fifteen subjects were asked to compare different pairs of items. For instance, pairs of animals were compared in regard to size (concrete) and ferocity (abstract). Subjects pressed a key to indicate the pair member which had a greater value on the tested dimension. Results showed that subjects tended, on the average, to require more time (81 msec) for abstract judgements than for concrete judgements. Kerst and Howard accounted for the differences by suggesting the possibility of parallel, independent memory codes for concrete and abstract information. Their conclusion thus further supported a dual-coding process. Furthermore, a visual memory code was assumed for concrete objects and items, and a verbal code for abstract information (Kerst & Howard, 1977; Paivio, 1975, 1978a).

Paivio (1975) asserted that images corresponding to concrete objects are activated more directly by pictures than by names (words). Paivio compared subjects' reaction time to pairs of pictures and pairs of words differing in size. Each subject was presented with either 48 picture pairs or with 48 word pairs. Similar to the Kerst & Howard experiment (1977), subjects were asked to press a key indicating the larger pair member. It was found that reaction times were faster with

pictures than with words, as predicted by the dual-coding hypothesis (Paivio, 1975 p. 642). Pictures were found to be consistently better recalled and recognized than words by numerous other studies (e.g., Levie & Levie, 1975; Paivio, 1971, 1978b; Pellegrino, Siegel & Dhawan, 1975). Thus, additional compelling support for the dual-coding hypothesis is available.

Dealing with an abstractness/concreteness dimension in instructional design creates, however, considerable difficulties. An abstractness/concreteness value varies both within and between learner populations, and cannot be ascertained by the instructional designer alone. The materials in normal instruction are also usually more complex than noun pairs or pictures. The level of abstractness may depend on the subjects' perception of the issue, item, or idea unit in question. To control for passage abstractness, Schmid and Kulhavy (in press) asked 60 subjects to norm experimental passages on seven-point abstractness/concreteness scales. This procedure ensured that the passages considered by the authors to be abstract or concrete did in fact belong to that category as perceived by the subject population.

Associated with the abstractness dimension, Dooling and Lachman (1971) found that prior knowledge of a topic facilitates retention by functioning as a mnemonic device. Anderson, Pichert, Goetz, Schallert, Stevens and Trollip (1976) further argued that the abstractness or concreteness level assigned to a word or to an idea may differ in each use: general terms are encoded on the basis of specific instances or exemplars derived from an already existing cognitive structure (Ausubel, 1968).

Clearly, perception of information as specific and concrete depends on the subject's prior knowledge of the context presented (Schmid, Note 5). In the present study, it was therefore necessary both to identify the learner's relative prior knowledge to the topic's content, and each group's (familiar to unfamiliar) perception of each idea unit's abstractness.

Abstractness in pictures. It is interesting to note that although pictures are usually considered concrete representations of information (Paivio, 1971, 1975), it is the idea behind the picture which determines the picture's meaningfulness. Franzwa (1973) claimed that meaningfulness plays an important role even in pictorial learning. Franzwa equated meaningfulness of material with subjects' familiarity with it. In his experiment, 123 subjects were randomly assigned to different treatment groups in which pictures of animals were either presented alone, with printed words, or with audio. The printed words and the audio were identical in content. The name of the animal showed in the picture was either printed or said. Subjects were shown 60 experimental slides at a 5-second exposure interval. Thirty of these slides were considered high-meaningful and 30 were considered to have low meaningfulness. Following the presentation, subjects were given a recognition test in which items consisted of pictures identical to the slides previously shown, and some distractors. A free-recall test was also given following another presentation of the slides, this time at a 7-second exposure interval. In the analysis of results it was found that highly meaningful pictures were generally

more readily recognized and recalled than low-meaningful ones. As to effects of presentation mode, low-meaningfulness scores differed significantly across treatment groups, while there were no significant differences among the high-meaningfulness scores. The addition of printed names to low-meaningful animal pictures lowered recognition accuracy. However, the addition of spoken names did not reduce recognition accuracy significantly. Overall, Franzwa contended that modality effects are dependent upon meaningfulness. Put another way, pictures classified as highly meaningful are in general more easily learned than those classified as low in meaningfulness, no matter if those low in meaningfulness are supported by verbal information or not (Franzwa, 1973). Interestingly, Franzwa's equation of meaningfulness with familiarity leads to the assumption that meaningful information is quite concrete to a subject, as he/she has prior knowledge of it (Schmid, Note 3). However, if an idea is considered abstract by a subject, a picture representing that idea may be considered quite abstract and meaningless as well (Paivio, 1971). One must note, though, that the simultaneous presentation of words with appropriate pictures usually increases meaningfulness and thus concretizes the presented information (Anderson, Pichert, Goetz, Schallert, Stevens & Trollip, 1976; Kolers & Smythe, 1979; Paivio, 1971). This, according to Franzwa (1973) and Severin (1967a), happens only if 1) the verbal content contains a helpful cue for elevating the meaningfulness of the presented picture, or 2) the picture provides a concrete representation of the information provided in the verbal part. Franzwa's and Severin's conclusions support Paivio's assertion that there are obvious additive

effects in learning tasks involving both pictorial and verbal information (Paivio, 1971, 1975, 1978a, 1978b; Paivio & Yarmey, 1966).

An instructional designer should attend very carefully to all the variables discussed above when planning instruction. Simultaneous presentation of verbal and pictorial information would benefit the learner if and only if the presented material is meaningful and the content in the two modalities is complementary, or highly meaningful and supplementary, as discussed by Salomon (1979).

Information processing of various modalities has been studied along a somewhat different vein by media researchers, and is reviewed in the following section which examines media as a means of multiple channel communication.

Media Literature Relevant to Dual Coding

As utilization of audio-visual aids in instruction has become more and more common, researchers in the media field have become interested in applying communication theory to instruction. In general, the goal of media researchers is to provide the learner with the optimal quantity and quality of stimuli or information input through different sensory channels (i.e., sound, sight, touch, etc.) (Levie & Dickie, 1973). Rather than being concerned merely with questions regarding learner characteristics, media literature emphasizes media characteristics suited for presentation of different kinds of information, for different types of learners, in different learning settings and situations. On a basic research level, the focus then is on channel capacity and optimal use of it for the benefit of the learner (Schoderbek,

Kefalas & Schoderbek, 1975).

Media literature has recently concentrated on the issue of presenting materials in different modes simultaneously (Dwyer, 1978). By reinforcing learning through one channel (or mode of presentation) with stimuli provided in other channels, it is hypothesized that information acquisition will increase (Hsia, 1971). The idea of using a multiple-channel approach rather than a single channel mode of presentation was advocated for two basic reasons: 1) a person's information processing capability is larger than the capacity of a single channel (Garner, 1962; Hsia, 1971), and 2) information presented redundantly in two or more channels simultaneously is better remembered (Arnheim, 1969; Hartman, 1961; Hsia, 1971; Severin, 1967a). Even Arnheim (1969), the advocator of "Visual Thinking" as the most important form of perception, admitted that verbal language helps thinking. Put another way, the two media, (visual and auditory) make up for each other's deficiences and therefore presentation of information in both of them simultaneously can result in more learning.

Channel capacity. There is an upper limit to the information processing capacity of a single channel (Shannon & Weaver, 1949). Information overload in a channel may result in ignoring some of the information transmitted, or in classification of the different bits of information not necessarily in the correct and desired order. The receiver or the learner may then be forced, consciously or unconsciously, to develop strategies and tactics to overcome information overload

problems (Boyd, Note 8). The problem which then arises is that crucial information may simply be ignored by the learner.

To avoid overloading of a single channel, a dual or even multiple channel approach is advocated. Man is capable of processing information through more than just one channel, as long as the flow of information is within the limit of each channel's information processing capacity (Travers, 1970). In reference to the same issue, Hsia (1971) asserted that the capacity of a multiple channel is not equal to the sum of capacities of all single channels involved. AV, for instance, does not have the capacity of the audio channel plus the capacity of the visual channel. Rather, it entails audio plus visual capacity minus between-channel redundancy (Hsia, 1971).

Redundancy means repetition, or duplication. By having redundancy, we have more reliability of acquiring the transmitted information (Schoderbek, Kefalas & Schoderbek, 1975). Hartman (1961) indicated that in studies in which related material was presented both through single and multiple channels, the multi-channel format was more effective. When complementary material was presented in different modalities simultaneously, memorability of information increased (Hartman, 1961; Severin, 1967a).

Clark (1978) hypothesized that multiple channel presentation of redundant information would be superior to single channel presentations and to nonredundant multiple channel presentations. Thirty-two subjects were presented with 15 geometric designs which they had to draw. Instructions for drawing the designs were given in five different treat-

ments: a) visual-only presentations--showing the design; b) printed instructions for drawing the designs; c) auditory descriptions; d) auditory descriptions with simultaneous visual presentation of the design; and e) auditory instructions while showing the person giving the instructions (Clark, 1978, p. 359). Subjects were tested for recall and recognition of the designs. In the analysis of the results, Clark found that performance on the auditory-visual redundant presentation was significantly higher than performance in all other treatments, as predicted by Paivio's dual-coding hypothesis (1971, 1978a, 1978b) and by Severin's cue summation theory (1967b). According to the cue summation theory, learning, or perhaps understanding, is increased as the number of cues or stimuli is increased (Dwyer, 1978). Indeed, the use of a visual and an auditory channel simultaneously creates a situation in which stimuli are provided both through the verbal coding system, and through the imagery coding system (Clark, 1978).

Another important finding in Clark's experiment was that the visual-only presentation yielded better results than the nonredundant audio-visual (showing the instructor). A nonredundant multi-channel presentation was interpreted to contain interfering information, thus retarding rather than enhancing learning.

The possibility of interference of information presented in one presentation mode with information presented in another mode is a factor that should be considered in planning instruction. The combination of presentation modes is crucial. Franzwa (1973) found that the combination

of printed words and pictures lowered recognition accuracy. However, when pictures were combined with audio; Franzwa did not find recognition accuracy lowered. A possible explanation for Franzwa's results is that printed words, although requiring verbal coding, also involve visual attributes because they are presented as visual representations of verbal information. Having to read while looking at a picture may involve interference of sequential perception of the verbal information with the spatial, holistic perception of the picture (Bernard, Note 2). Similarly, the combination of printed information with audio is not suggested. Although printed words may be considered visuals, they require sequential processing and do not necessarily activate the imagery system (Bernard, Note 2). Encoding of both audio and print is sequential, but does not necessarily occur at the same rate. Therefore, interference is anticipated.

The best combination of presentation modes is therefore that of auditory (verbal) with visual (pictorial). When information is presented simultaneously in the verbal mode and in the picture (imagery evoking) mode, the two systems reinforce each other rather than interfere with each other (Paivio, 1978b; Severin, 1967b).

Further support for the use of a two channel redundant presentation was provided by Roth and Issing (1970). Subjects in the Roth and Issing experiment were randomly assigned to four treatment groups. In each group, the experimental text was presented in a different mode: 1) sound and picture; 2) textual information presented by the moderator on the

screen; 3) sound presentation only; and 4) picture presentation only. Following the presentation, a multiple choice test was administered to the subjects. Subjects in the redundant two channel presentation (visual plus aural) did significantly better than those in the single channel treatment groups. Roth and Issing claimed that the results obtained occurred only because the combination of the two presentation modes did not cause an overloading of the students' channel capacity. Items presented in one modality were therefore supported by the information from the other modality.

The implications of these data are that instructional content should be presented in two or more channels, and that one must take into account the positive effect of redundancy on memorability of materials. Information presented in the two (or more) channels should be complementary. Supplemental information can also be added, especially in the visual mode, but only to a limited extent. Hartman (1961) noted a tendency by the communicator or the instructor to fill the pictorial (visual) channel with as much information as possible. This increases the possibility of overloading the visual channel and interfering with the auditory channel, thus inhibiting student information acquisition (Severin, 1967b). There exist no prescriptive guidelines for balancing these variables optimally.

Interaction of Learning Research with Media Research

The conception of a dual-coding system is heavily supported by research both in learning theory and in the media literature (e.g. Arnheim, 1969; Clark; 1978; Fleming & Sheikhian, 1972; Kolers & Smythe,

1979; Kosslyn & Pomeranz, 1977; Paivio, 1971, 1975, 1976, 1978a, 1978b; Shepard, 1967). However, because the encoding of pictures is particularly difficult to analyze experimentally, or even theoretically, there have been attempts to explain the coding system as unimodal, or better said, submodal (Anderson & Bower, 1973; Pylyshyn, 1973). Contrary to the dual code model, Pylyshyn (1973) argued that visual information is encoded in the same sort of format that is used to encode verbal information. Imagery is seen as a procedure, and plays no causal role in information processing. Nevertheless, a learner's observable behavior is profoundly affected by the use of imagery, regardless of its role in specific information processing models. Most empirical evidence, both in learning psychology and in media, supports the assertion for a dual code (Anderson, 1978), and it is thus treated in this study as a "real" factor.

The basic difference between research studies in learning theory and those dealing with media and communication is in the type of variables dealt with in each field. Learning theories are mainly concerned with how information is perceived, encoded, and processed, and study the effects of variables such as abstractness, and meaningfulness of materials, and prior knowledge of the learner (Paivio, 1971, 1975, 1978a, 1978b; Paivio & Csapo, 1969, 1973; Schmid & Kulhavy, in press). The media literature focuses on factors related to the delivery system, and attributes related to its structure. Researchers in the media field (e.g. Dwyer, 1978; Franzwa, 1973; Hartman, 1961; Hsia, 1971; Roth & Issing, 1970) have therefore been dealing with message complexity,

channel capacity, redundancy and interference.

In effect, both fields ultimately direct all research implications to improving instruction and benefiting the learner (Salomon, 1974). It seems logical that if "a picture is worth a thousand words", some of these "words", or details conveyed, would be lost if not supported by verbal information (Salomon, 1974). Similarly, a picture well matched with a verbal message may have a tremendous additive effect to the memorability of the verbal message (Shepard, 1967).

Basic research relating to this issue is needed both in learning theory and in the media literature. Factors dealt with in both areas must be integrated by instructional designers in order to be able to execute better instructional programs. Perhaps even more importantly, researchers must provide instructional designers with concise, empirically sound, operational prescriptions on how the results of basic research might be applied in a natural setting. Such an attempt is made in the present study.

CHAPTER 3

Method

Design and Subjects

Three factors--Presentation Modality, Content Familiarity, and Test Interval--were tested. Three levels of Content Familiarity formed the between-subjects variable in the experiment. Presentation Modality and Test Interval were varied as within-subjects factors. The design was thus a 3 Familiarity (high--graduate accounting students--versus medium--undergraduate accounting students--versus low--undergraduate education students) X 3 Modality (visual versus auditory versus visual and auditory) X 2 Test Interval (immediate versus delay) mixed model (see Figure 1).

The subjects were 50 graduate accounting students, 63 undergraduate accounting students and 45 undergraduate education students. Graduate accounting students have successfully completed at least six graduate level accounting courses. All graduate accounting students were enrolled, at the time of the experiment, in a course on accounting theory. Undergraduate accounting students were classified as those having successfully completed at least one financial accounting course and one managerial accounting course. Education students could not have taken any university-level accounting courses. All subjects who had knowledge specific to the content of the presentation were excluded from the study. Of the total pool of subjects, 20 graduate accounting students, 23 undergraduate accounting students, and 12 undergraduate education students were randomly selected for a norming study, thus

Figure 1

Experimental Design.

MODALITY	FAMILIARITY: Graduate Accounting Students	Undergraduate Accounting Students	Undergraduate Education Students
Auditory	Immediate/Delay	Same	Same
Visual	Same	Same	Same
Auditory-Visual	Same	Same	Same

leaving 30 graduate accounting students, 40 undergraduate accounting students and 33 undergraduate education students for the actual experiment. All subjects were students at Concordia University.

Materials

The experimental materials consisted of a sound-slide presentation on "Approaches to the Preparation of Consolidated Financial Statements", a test in which subjects were asked about the information presented to them in the sound-slide show, and biographical data relevant to group membership.

In order to generate the sound-slide production and recognition test materials, the instructional design process and a norming procedure had to first be conducted.

Norming procedure. The topic for the sound-slide presentation was selected by the instructor of the graduate accounting subjects as part of the normal sequence of his course. The instructor provided a list of objectives to be achieved in the process of learning that topic. Based on these objectives, the author conducted an instructional analysis. The instructor was asked to comment on the instructional analysis, i.e., aid in clarifying the hierarchical and procedural order among the instructional objectives and approve the final version of the analysis. Furthermore, he provided a general text that was used as a basis for generating the actual presentation, and indicated in which modality (in his opinion) each part of the text should be presented.

At this stage, the author prepared a story board in which both the script and the visuals were indicated as they would appear in the

actual sound-slide presentation. The instructor was asked to comment on the textual information presented and on the modes of presentation. Remarks of a media expert regarding presentation modes were also solicited and taken into consideration, and the story board was modified accordingly. These materials thus formed the final production and the source of test items.

The subject matter expert (i.e., the instructor) and two other accountants were next asked to identify what in their view were the idea units presented on the story board. An idea unit was defined as a sentence, clause or phrase which contains a single complete idea, or a single block of information. A composite list of idea units provided by the accountants was used as the master list for the evaluation of subjects' idea unit recall, and for the generation of recognition test items. One hundred and six ideas were determined as being represented in the script. Of these, 39 were auditory, 12 were visual and 60 were audio and visual. To create the recognition test, logical distractors similar to the idea unit list were generated, which eventually constituted about 30% of the recognition test items.

All the idea units, distractors, plus 16 preselected pictures including four distractors, were subject to a norming procedure. The abstractness/concreteness norming procedure was conducted in order to control for variations in the results of the main experiment due to different levels of abstractness/concreteness of the idea units as perceived by the three different familiarity levels. Subjects in the norming study received response forms listing all the idea units randomly ordered in major categories to maintain conceptual context, the

distractors, and the pictures. Along side each idea unit and picture was a five-point Likert-type scale. This abstractness/concreteness scale was labeled from 1 to 5, "1" designating a high level of abstractness and "5" designating high concreteness. The concept of abstractness/concreteness was defined as the degree to which a stimulus evokes an image, or a mental picture, the stimuli here being the idea units as previously defined. The norming procedure instructions and the actual script divided into idea units can be found in Appendix A. The pictures and distractors are located in Appendix B under Recognition Test materials.

Main experiment. Subjects in the main experiment received an experimental packet containing instructions, an interpolated task of nine arithmetic problems, three lined sheets for free recall, and a recognition test containing items and pictures corresponding to the list of idea units. (See Appendix B.)

The recognition test consisted of 54 items (17 of which were distractors) and 16 pictures (including four distractors). Idea units and pictures were carefully selected from the story board to represent all the concepts and principles represented in the instructional analysis. Attention was also paid to the number of verbal recogniton items which fell at level one and two of Bloom's taxonomy, such that 18 measured knowledge, and 18 comprehension (three of which might be considered to be at the application level). Finally, a balance of auditory only, visual only, and auditory/visual items were selected, with 17 AV, 14 auditory, and five visual. The 12 presented pictures were evenly divided between visual only and visual with an accompanying

audio description (AV).

The recognition test items asked subjects to indicate whether each item and picture was or was not presented in the sound-slide show. If the subjects responded that the item was presented, they were next asked how confident they were of their response on a five-point Likert-type scale, "1" designating guessing, or very low confidence, "5" indicating high confidence. They were then asked on the verbal items in which modality the item was presented (i.e., visually, auditorily or in both modalities. For the picture items, following the confidence ratings, subjects were asked to write a very brief statement indicating what the picture meant.

If the item was judged not to have been presented, learners were asked to indicate if the verbal statement was true or false, and also marked down their confidence in the response. All distractors and the actual idea units were ordered randomly and treated in the same format. (See Appendix B).

The questionnaire for all subjects (from the main experiment and the norming study) contained general questions pertaining to biographical information regarding the subjects' familiarity with the topic, accounting background, and general interest in the topic.

All subjects were also given the Paivio Individual Differences Questionnaire (IDQ) (Paivio, 1971) sometime prior to the experimental session. The test measures Imagerial versus Verbal thinking strengths of different individuals.

Procedure

The Paivio Individual Differences Questionnaire was administered by the instructor of each class during regular class meetings as general information gathering on his/her part. This test preceded the experimental session by at least three weeks.

On the day of the study, during regularly scheduled class periods, experimental packages (all instructions and materials in coded envelopes) were distributed so that approximately two-fifths of each group received the norming materials, and the remaining received free recall sheets and a recognition test pertaining to the main experiment. For counterbalancing purposes, half of the subjects received packages in which verbal items appeared first, followed by the pictorial items, and half were given pictorial items first, then verbal items.

Following some introductory comments, all subjects were asked to read the general instructions silently while the moderator read them aloud. (See Appendix C.) They were told to view and listen to the presentation attentively, and to try to remember as much of it as they could, as they would be tested on the content. Notetaking was not permitted. Rather, it was explained that comprehension of the content was critical, and that they would have ample opportunity to take notes later.

Following the presentation, all subjects completed a one-minute interpolated task. Subjects in the main experiment then worked for 10 minutes on the free recall task. Subjects in the norming study were provided with a list of idea units and pictures, asked to carefully read

the instructions provided for that task, and, if there were no questions, asked to rate them for abstractness. After 10 minutes, subjects in the main experiment were asked to place the free recall sheets to the side and were given the recognition test. They were asked to answer all questions as quickly and as accurately as possible. Subjects in the norming procedure were reminded to continue working on their task at their own pace. A 20-minute time limit for completing the recognition test was imposed. Those who finished early were asked to check their work and wait quietly for everybody to finish. All the students were then asked to complete the short biographical questionnaire. All tests and questionnaires and norming forms were collected.

Subjects were thanked and told that we would return the following week to explain the results.

One week later, (at the next scheduled class period), repeated measures of the free recall task and the recognition test of the main experiment were taken. All subjects completed the main experiment tasks this time. Post-test results were analysed only for the main experiment group.

The results of the previous week's data were explained following the delayed post-test.

CHAPTER 4

Results

This chapter first presents results of the analysis of scores in the abstractness/concreteness norming procedure. These data were used to define the abstractness dimension of the recall and recognition dependent variables by a blocking procedure. Then, the different analyses conducted on data from the main experiment are discussed.

Norming Procedure

Subjects were asked to rate each idea unit and picture tested in the main experiment for abstractness/concreteness level. Responses were made on a five-point scale, with "1" meaning abstract, "3" designating medium and "5" representing concrete. The mean abstractness level was then computed for each item separately for each of the three familiarity groups. The item means were ordered and divided into three equal groups--the bottom third labeled abstract, the middle third medium, and the upper third concrete, again for each familiarity level. The assigned labels were thus used as abstractness level indicators for items and pictures recalled and recognized by subjects in the main experiment. (See Appendix E)

Main Experiment

The main experiment protocols were scored and analysed separately for the free recall task, for recognition test items, and for recognition test pictures.

The Free Recall results were tested in three sets of analyses. First examined were the total words and idea unit scores. Next, subjects' idea unit recall was analysed for modality effects. Finally, the abstractness level effect on free-recall was examined.

The recognition test was first analysed for overall (total) recognition of presented and nonpresented items and pictures. Next, the effect of presentation modality of presented items was examined, followed by an analysis of subjects' recognition of correct presentation modalities of recognized test items. The effect of abstractness level on recognition of presented and nonpresented items and pictures was also analysed. Confidence recognition level of presented and nonpresented items and pictures was examined as well. In addition, each analysis was tested for Immediate/Delay effects.

Free Recall

Total words and idea units. The free recall protocols were first scored for total words and idea units recalled. Both scoring procedures excluded repetitions and intrusions (Schmid & Kulhavy, in press).

The composite list of idea units discussed in the Materials section of Chapter 3 provided the key from which scoring of idea unit recall was accomplished. Each idea unit in the text was assigned an identification number, one through 106. Scoring was done by labeling each idea in the recall protocol with the number corresponding to the

idea in the master list. The total number of idea units recalled was then counted. All free recall data was scored by the author and by the subject-matter expert. In spite of the extreme complexity of the matching procedure, an inter-rater reliability of .98 was obtained. The means and standard deviations for both total words and idea units across the three experiemental groups are listed in Table 1. The familiarity factor main effect on total words was statistically significant, $F(2,100) = 24.78$, $p < .001$. A Scheffé post hoc analysis ordered the means Graduate = Undergraduate > Education ($F(2,100) = 6.15$, $p < .01$ and $F(2,100) = 6.09$, $p < .01$, respectively). Immediate scores were higher than delayed scores, $F(1,100) = 98.28$, $p < .001$.

The idea unit analysis yielded a significant familiarity X test interval interaction, $F(2,100) = 4.84$, $p < .01$. Analyses of interaction simple effects comparisons ranked the immediate test means Graduate > Undergraduate > Education (all $p < .01$). On the delayed test, no difference was found between the two higher familiarity groups, which outperformed the low familiarity group ($p < .01$).

Modality of free recall idea units. Each idea unit was determined to have been presented in either visual-only, auditory-only, or audio-visual form in the production of the presentation. A tabulation was made of how many idea units each subject recalled from each format. Thus, each learner received three scores, one point per idea, yielding a total number of auditory ideas free recalled, number of

Table 1

Means and Standard Deviations of Scores on Total Words and on Total Idea Units Correctly Recalled*

	Total Words	Idea Units
Graduate Accounting (n=30)		
Immediate	M=138.27 SD= 56.17	M=17.60 SD= 7.31
Delay	M= 88.40 SD= 50.10	M=11.20 SD= 5.84
Undergraduate Accounting (n=40)		
Immediate	M=133.62 SD= 48.24	M=14.32 SD= 5.90
Delay	M= 84.62 SD= 34.77	M=10.32 SD= 4.39
Undergraduate Education (n=33)		
Immediate	M= 73.36 SD= 35.28	M= 8.45 SD= 4.15
Delay	M= 42.06 SD= 21.66	M= 6.27 SD= 2.58

*All means are weighted in all analyses

visual ideas recalled, and number of A/V units recalled. Means and standard deviations are presented in Table 2. The analysis yielded three interactions. Figure 1 graphically represents the familiarity X modality interaction, $F(4,200) = 11.37$, $p < .001$. The simple effects post hoc test showed no differences across the three groups for audio-only and visual-only items, but a significant increment in performance with increased familiarity on AV items: Graduate > Undergraduate > Education, ($F(2,200) = 2.98$, $p < .05$ and $F(2,200) = 22.87$, $p < .001$, respectively).

The familiarity X test interval and modality X test interval interactions were also significant, $F(2,100) = 4.50$, and $F(2,200) = 19.57$, both $p < .01$, respectively. In both interactions, decrements in performance were observed from immediate to delay, except where initial recall was low. Thus, abstract items failed to decrease significantly in the case of education students.

Abstractness/concreteness level of free recall idea units. Each idea unit's abstractness/concreteness level was derived in the norming procedure, by the three familiarity groups separately. The idea units were assigned an abstract, medium or concrete label according to the key constructed from the norming procedure results. Total number of abstract, medium, and concrete idea units recalled was then tabulated for each subject, yielding three separate scores. One point was assigned for each idea recalled. Means and standard deviations are listed in Table 3. The three two-way interactions

Table 2

Means and Standard Deviations for Scores on Audio, Visual, and Audio-Visual Idea Units Correctly Recalled

	Audio	Visual	Audio-Visual
Graduate Accounting (n=30)			
Immediate	M=2.53 SD=1.50	M=3.33 SD=3.62	M=11.63 SD=5.33
Delay	M=1.30 SD=1.12	M=2.33 SD=2.54	M=7.57 SD=4.72
Undergraduate Accounting (n=40)			
Immediate	M=2.15 SD=1.53	M=3.02 SD=3.89	M=9.15 SD=3.60
Delay	M=1.32 SD=1.00	M=2.35 SD=2.83	M=6.75 SD=3.32
Undergraduate Education (n=33)			
Immediate	M= .88 SD=1.02	M=2.73 SD=2.67	M=4.85 SD=2.86
Delay	M= .58 SD= .66	M=2.52 SD=2.08	M=3.18 SD=1.86

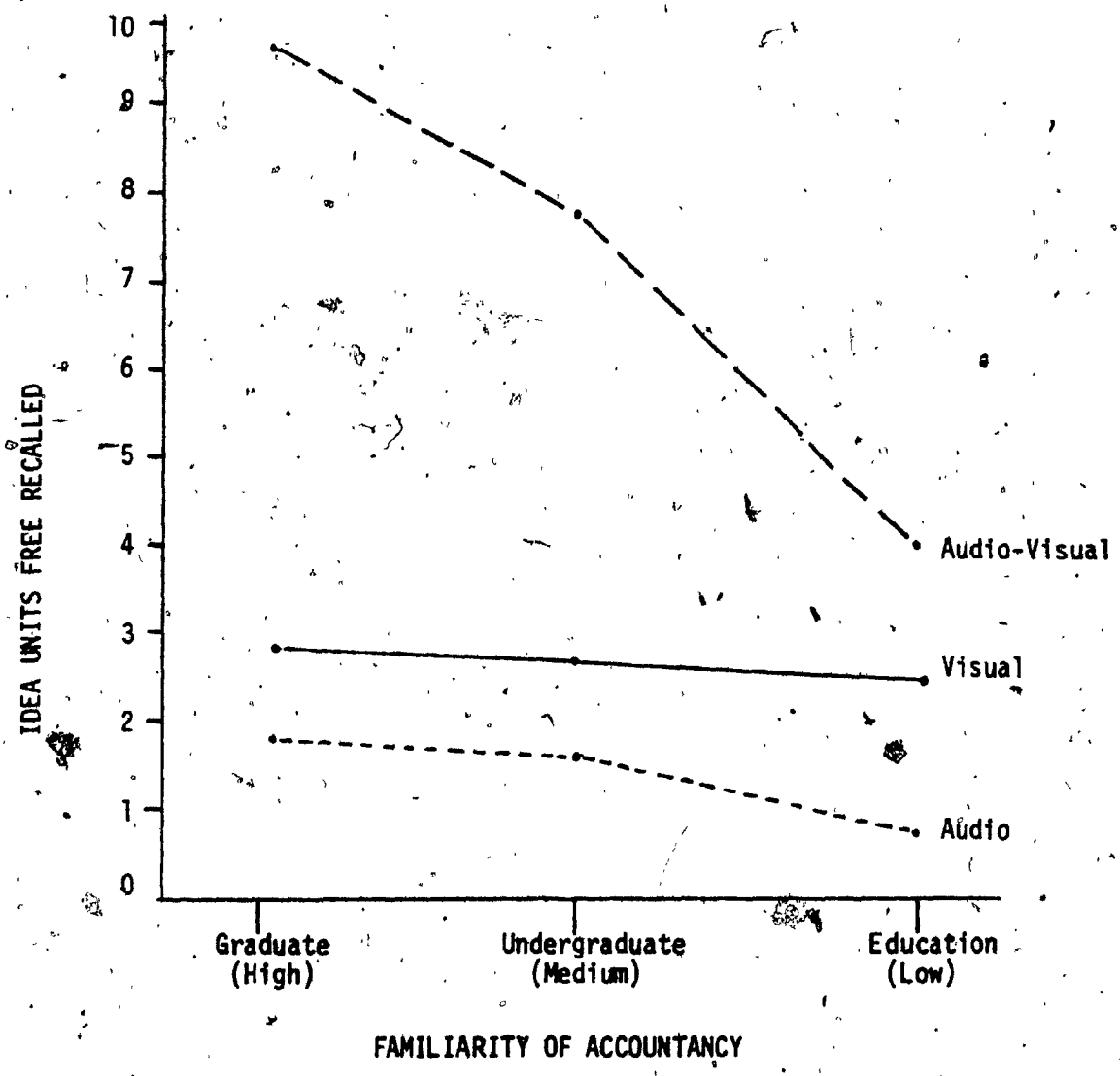

Figure 2. Mean Number of Total Idea Units Recalled for Cells of the Familiarity X Modality Interaction.

Table 3

Means and Standard Deviations for Scores on Abstract, Medium and Concrete Idea Units Correctly Recalled

	Abstract	Medium	Concrete
Graduate Accounting (n=30)			
Immediate	M=2.97 SD=2.61	M=3.67 SD=2.40	M=8.07 SD=3.20
Delay	M=1.63 SD=1.59	M=2.23 SD=1.94	M=5.57 SD=2.99
Undergraduate Accounting (n=40)			
Immediate	M=2.15 SD=1.49	M=3.68 SD=2.04	M=5.80 SD=2.17
Delay	M=1.17 SD=1.28	M=2.70 SD=1.68	M=4.15 SD=1.53
Undergraduate Education (n=33)			
Immediate	M= .39 SD= .86	M=1.39 SD=1.50	M=3.91 SD=1.86
Delay	M= .39 SD= .86	M= .88 SD= .82	M=2.36 SD=1.25

were significant, as was the case in the modality analysis. The familiarity by abstractness interaction can be seen in Figure 2, $F(4,200) = 10.21$, $p < .001$. All three familiarity groups recalled significantly more concrete items, and also showed a significant increment in performance with increased familiarity: Graduate > Undergraduate > Education, ($F(2,200) = 8.42$, $p < .01$ and $F(2,200)$ 16.09, $p < .01$, respectively). Both the Graduate and Undergraduate groups performed equally well on the medium and abstract items, but significantly better than the Education students (both $p < .01$). The familiarity X test interval interaction yielded significant differences, $F(2,100) = 3.41$, $p < .04$. Immediate scores were greater than delay on all but the low familiarity subjects.

The Abstractness by Test Interval interaction was statistically different, $F(2,200) = 12.38$, $p < .001$. Again, immediate was greater than delay except on the abstract items.

Recognition Test

Verbal-pictorial counterbalancing. The first test conducted on recognition items (pictorial and verbal) was a t - test to assess whether the counterbalancing of materials was effective. As already explained in chapter 3, half of the subjects in each group received the recognition verbal items first, and then the pictures, and vice versa. All t - tests yielded no significant differences between the two sections within each group. Scores were thus pulled across the counterbalancing factor in all subsequent analyses.

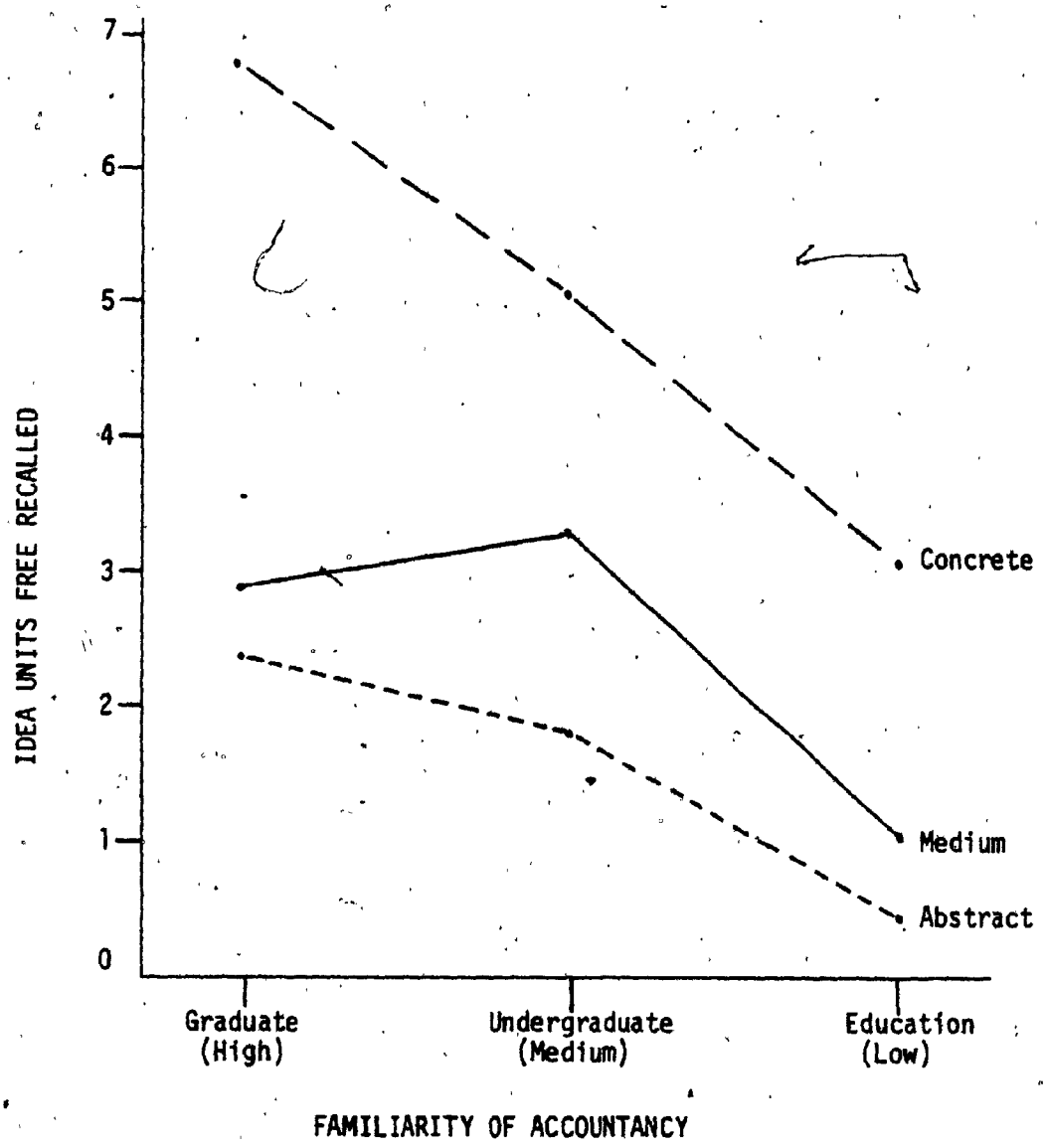

Figure 3. Mean Number of Total Idea Units Recalled for Cells of the Familiarity X Abstractness Interaction.

Total presented and non-presented verbal items correctly recognized. In the recognition test, subjects were asked to indicate whether an item was presented in the sound-slide program or not. If the item was not presented, the subject was also asked if it was true or false. Scores were calculated by assigning one or two points for each complete answer. Two points were assigned if an item was correctly identified by the subject as having been presented. One point was assigned if an item was correctly marked as not having been presented. In addition, if the true or false question was answered correctly, the subject received another point. Subjects were reminded that presented items were necessarily true. Thus the total possible points for both presented and non-presented verbal items was two. Total points for all presented and for all non-presented items correctly identified were thus generated for each learner. Means and standard deviations can be found in Table 4.

Modality effects on recognition of presented items. Each presented item correctly recornized was classified as either audio (A), visual (V), or audio-visual (AV). A master key, prepared at the planning stage of the sound-slide program was used in the modality classification process. The number of A, V, and AV items in the master key was not proportionate (A = 14 items, V = 5 items, AV = 17 items). Therefore the percentage of correctly recognized items to the total number of items presented was used in the analysis. Learners received three scores: percent of audio items correctly

Table 4

Means and Standard Deviations for Scores on Presented and Nonpresented Items Correctly Recognized

	Presented Correct	Nonpresented Correct
Graduate Accounting (n=30)		
Immediate	M=28.27 SD=13.81	M=12.53 SD= 5.73
Delay	M=30.27 SD=12.94	M=14.40 SD= 5.57
Undergraduate Accounting (n=38)		
Immediate	M=28.21 SD=15.23	M=11.63 SD= 6.61
Delay	M=34.89 SD=15.02	M=11.63 SD= 5.54
Undergraduate Education (n=29)		
Immediate	M=36.10 SD=15.56	M= 9.24 SD= 4.48
Delay	M=43.07 SD=14.36	M= 8.17 SD= 3.71

recognized, percent of visual items correctly recognized, and percent of AV units correctly recognized. Means and standard deviations are presented in Table 5. The analysis produced a significant familiarity by modality interaction, $F(4, 198) = 5.38$, $p < .001$, and can be seen in Figure 3. Education students performed equally well on all three item types, and significantly better than the higher familiarity groups on both AV and A items, with simple effects $F(2,198) = 5.00$, and $F(2,198) = 8.38$, both $p < .01$ respectively. Both Graduate and Undergraduate scores across AV and A items were the same, with AV greater than A.

Delay test results were found to be higher than those of the immediate test, $F(1,99) = 15.39$, $p < .001$.

Correct modality recognition. In order to determine whether the modality of a presented item remains attached to the item itself in subjects' memory, subjects were asked to identify the modality in which each item was presented. The number of A, V, and AV items correctly identified by each subject were again transformed into percentages calculated out of the total number of recognized A, V, and AV items. Three scores were thus generated for each learner. Means and standard deviations are listed in Table 6. The familiarity main effect was significant, $F(2,98) = 5.57$, $p < .01$. Scheffé comparisons ordered the means such that Graduates performed better than Education students, both of which did not differ from the Undergraduates. AV items were also found to be more effectively

Table 5

Means and Standard Deviations for Percentages of Audio, Visual and Audio-Visual Presented Items Correctly Recognized

	Audio	Visual	Audio-Visual
Graduate Accounting (n=30)			
Immediate	M=31.57 SD=18.76	M=51.67 SD=32.12	M=45.00 SD=20.82
Delay	M=36.63 SD=20.89	M=57.50 SD=30.19	M=44.93 SD=17.53
Undergraduate Accounting (n=40)			
Immediate	M=31.57 SD=21.59	M=50.00 SD=30.49	M=42.68 SD=24.05
Delay	M=40.38 SD=23.41	M=58.75 SD=31.80	M=49.95 SD=24.15
Undergraduate Education (n=32)			
Immediate	M=46.94 SD=22.69	M=53.12 SD=26.63	M=52.25 SD=25.83
Delay	M=59.94 SD=22.36	M=61.72 SD=31.74	M=62.97 SD=22.54

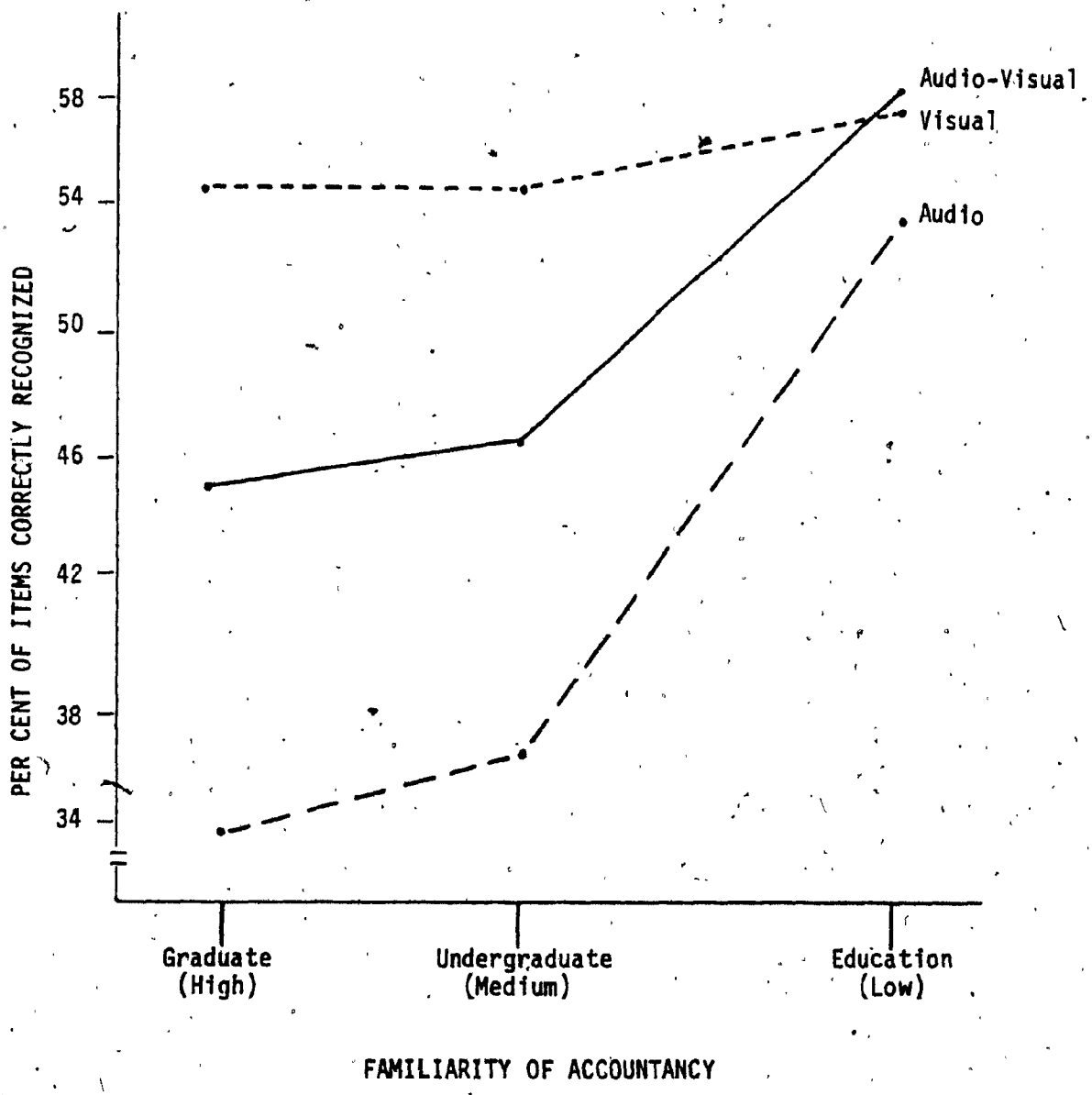

Figure 4. Mean Percent of Items Correctly Recognized for Cells of the Familiarity X Modality interaction.

Table 6

Means and Standard Deviations for Percentages of Audio, Visual and Audio-Visual Presented Items Correctly Recognized and Correctly Identified for Modality

	Audio	Visual	Audio-Visual
Graduate Accounting (n=30)			
Immediate	M=31.23 SD=34.17	M=23.83 SD=29.16	M=65.50 SD=29.36
Delay	M=31.87 SD=29.64	M=21.40 SD=33.84	M=70.70 SD=30.64
Undergraduate Accounting (n=39)			
Immediate	M=21.90 SD=25.03	M=20.51 SD=33.61	M=66.41 SD=25.40
Delay	M=24.05 SD=27.20	M=21.13 SD=27.62	M=73.77 SD=22.28
Undergraduate Education (n=32)			
Immediate	M=18.12 SD=21.06	M= 7.28 SD=20.59	M=73.97 SD=23.65
Delay	M=22.91 SD=27.08	M= 6.25 SD=20.08	M=66.25 SD=28.68

identified in the modality main effect, $F(2,196) = 137.30$, $p < .001$.

Response confidence on presented and non-presented verbal recognition items. Response confidence scores were made on five-point scales, from "1" meaning not (at all) confident, to "5" representing complete confidence. The mean confidence rating for presented and non-presented items was then computed separately for each subject. Means and standard deviations are shown in Table 7. Both the familiarity and test interval effects showed differences, $F(2,98) = 13.97$, and $F(1,98) = 6.36$, both $p < .01$. The Scheffé post hoc analysis ranked the familiarity factor means: Graduate = Undergraduate > Education (all $p < .01$). Immediate confidence was greater than delay.

Abstractness effects on correctly recognized presented and non-presented items. As noted above, test items were proportionately divided into three abstractness levels (i. e., abstract, medium, & concrete). Both presented and non-presented items correctly recognized were combined in this analysis. Means and standard deviations are shown in Tables 8 and 9.

The analysis produced a significant familiarity by abstractness effect, $F(4,198) = 14.22$, $p < .001$ (see Figure 4). Graduates differed on all three levels of abstractness, ordered Concrete > Medium > Abstract ($F(2,198) = 16.72$, and $F(2,198) = 14.57$, both $p < .01$, respectively on simple effects). Undergraduates scored better than Graduates on medium items but did not differ from their own

Table 7

Means and Standard Deviations of Scores on Confidence Levels of Presented and Nonpresented Items Correctly Recognized

	Presented Correct	Nonpresented Correct
Graduate Accounting (n=22)		
Immediate	M=4.19 SD= .67	M=4.26 SD= .74
Delay	M=4.14 SD= .61	M=3.97 SD= .67
Undergraduate Accounting (n=32)		
Immediate	M=4.14 SD= .62	M=3.82 SD= .69
Delay	M=3.81 SD= .81	M=3.46 SD= .79
Undergraduate Education (n=23)		
Immediate	M=3.45 SD= .60	M=3.10 SD=1.01
Delay	M=3.08 SD= .84	M=2.51 SD=1.06

Table 8

Means and Standard Deviations for Scores on Abstract, Medium and Concrete Presented Items Correctly Recognized

	Abstract	Medium	Concrete
Graduate Accounting (n=30)			
Immediate	M=2.53 SD=1.94	M=4.23 SD=1.79	M=7.37 SD=3.95
Delay	M=2.97 SD=1.69	M=4.37 SD=1.67	M=7.80 SD=3.85
Undergraduate Accounting (n=40)			
Immediate	M=2.58 SD=1.68	M=5.18 SD=2.99	M=5.90 SD=3.87
Delay	M=3.55 SD=1.87	M=6.05 SD=3.17	M=7.08 SD=3.98
Undergraduate Education (n=32)			
Immediate	M=5.38 SD=2.34	M=5.13 SD=2.66	M=7.13 SD=3.40
Delay	M=6.75 SD=2.30	M=6.25 SD=2.70	M=8.94 SD=3.48

Table 9

Means and Standard Deviations for Scores on Abstract, Medium and Concrete Nonpresented Items Correctly Recognized

	Abstract	Medium	Concrete
Graduate Accounting (n=30)			
Immediate	M=2.73 SD=1.64	M=2.60 SD=1.48	M=2.40 SD=1.13
Delay	M=3.27 SD=1.53	M=2.87 SD=1.25	M=2.43 SD=1.10
Undergraduate Accounting (n=38)			
Immediate	M=2.74 SD=1.25	M=2.18 SD=1.41	M=2.26 SD=1.45
Delay	M=2.71 SD=1.31	M=2.68 SD=1.34	M=2.16 SD=1.39
Undergraduate Education (n=29)			
Immediate	M=2.00 SD=1.20	M=1.45 SD=1.02	M=2.97 SD=1.55
Delay	M=1.97 SD=1.27	M=1.79 SD=1.15	M=2.31 SD=1.23

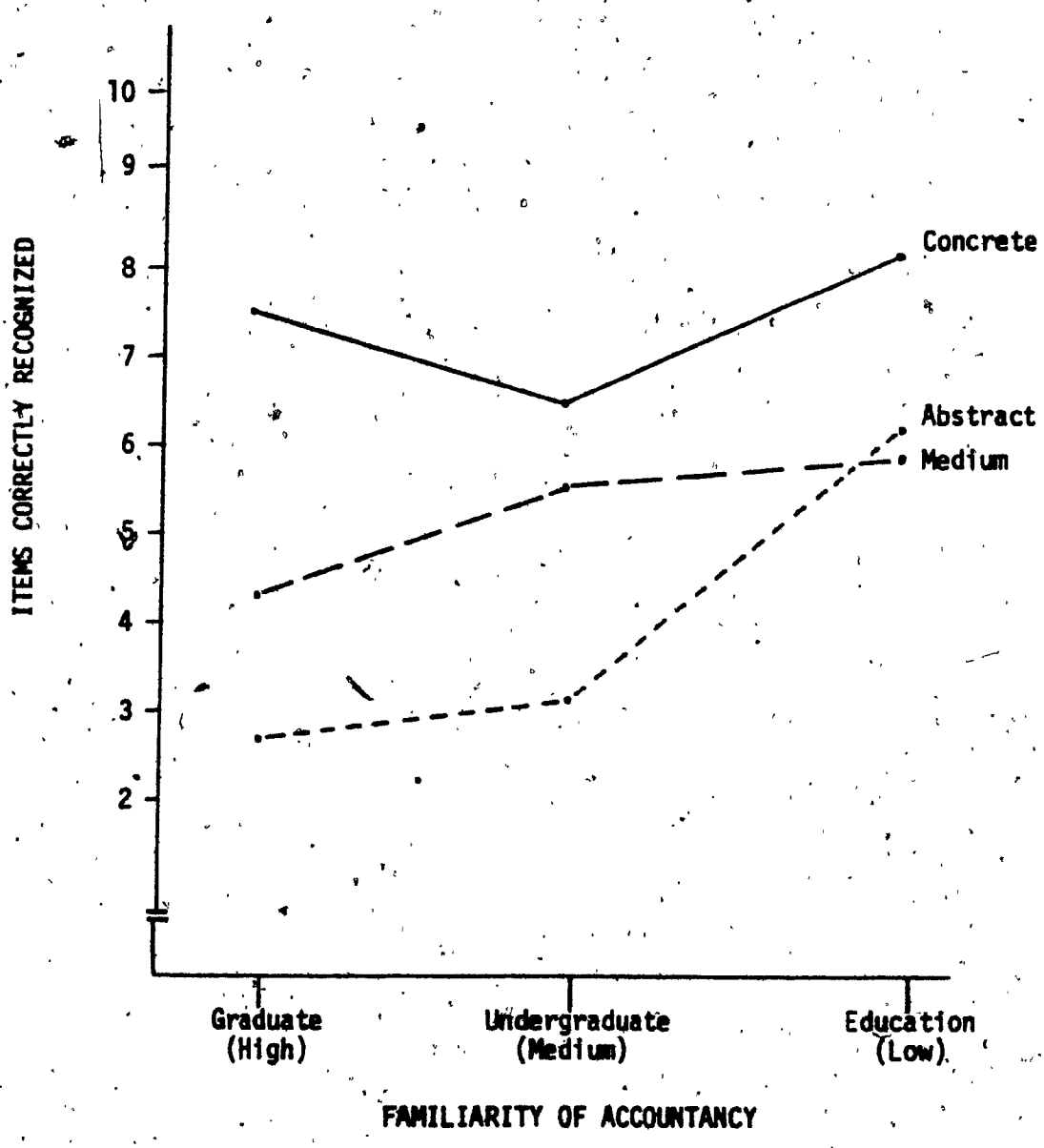

Figure 5. Mean Number of Items Correctly Recognized for Cells of the Familiarity X Abstractness Interaction.

concrete scores. Finally, education students recognized significantly more concrete items than abstract or medium, $F(2,198) = 9.84$, $p < .001$, as well as more abstract items than either high familiarity group.

Delay recognition test scores outstripped immediate performance, $F(1,99) = 21.47$, $p < .001$.

Total presented and non-presented pictures correctly recognized. As with the verbal recognition items, subjects were asked to indicate whether pictures provided in the recognition test were presented in the sound-slide production or not. If a picture was identified as "presented", subjects were also asked to recallwhat the picture represented (meant). Scores were calculated by assigning one point for a presented picture correctly identified as such. An additional point was given if the subject recalled what the picture represented. One half point was assigned for a partial response regarding a picture's meaning. Two points were assigned for non presented pictures, correctly identified as such. Thus, as in the scoring of items, the total possible points for all presented and non presented pictures was two. Means and standard deviations are shown in Table 10.

The analysis of variance yielded a significant familiarity by test interval interaction, which can be seen in Figure 5 ($F(2,58) = 3.60$, $p < .05$. The low familiarity subjects performed significantly worse than the other two groups, which did not differ. Presented pictures were more often correctly identified than the distractors (non-presented pictures), $F(1,58) = 163.96$, $p < .001$.

Table 10

Means and Standard Deviations for Scores on Presented and Nonpresented Pictures Correctly Recognized

	Presented Correct	Nonpresented Correct
Graduate Accounting (n=17)		
Immediate	M=12.18 SD= 4.67	M=4.82 SD=2.13
Delay	M=12.97 SD= 4.06	M=5.35 SD=2.26
Undergraduate Accounting (n=20)		
Immediate	M=14.23 SD= 3.69	M=5.90 SD=1.52
Delay	M=13.18 SD= 3.71	M=4.80 SD=1.99
Undergraduate Education (n=24)		
Immediate	M= 9.67 SD= 4.42	M=5.08 SD=1.86
Delay	M=10.73 SD= 3.92	M=4.33 SD=1.63

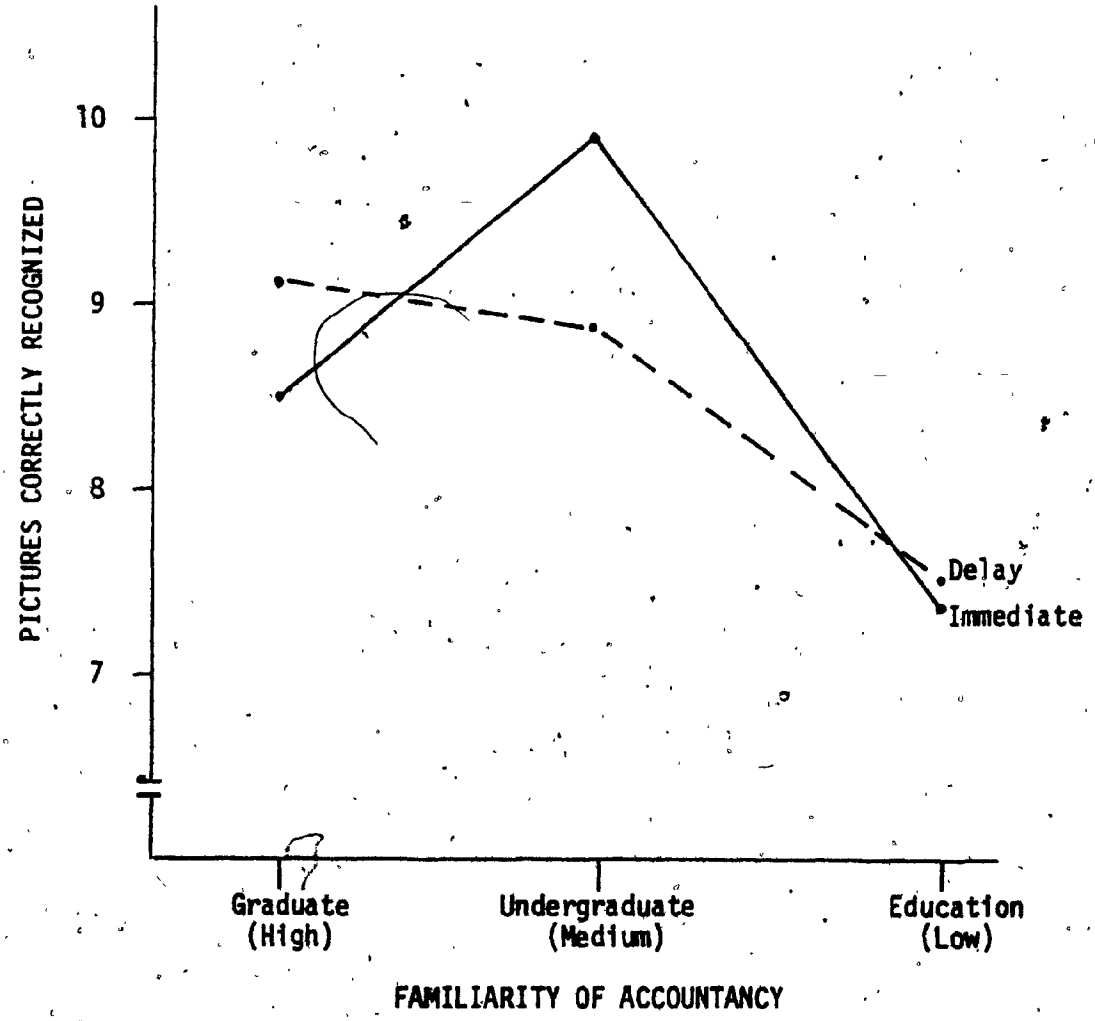

Figure 6. Mean Number of Pictures Correctly Recognized for Cells of the Familiarity X Test Interval Interaction.

Individual differences questionnaire (IDQ) effects. Paivio's IDQ's were scored separately for imagery items (n = 23) and for verbal items (n = 31). Because the number of verbal and imagery items was not the same, proportions of each type were calculated for each subject. A single IDQ score was computed by subtracting the proportion of verbal items from that of imagery items. Thus scores varied between 1.00 and -1.00, with negative proportions indicating verbal strength and positive proportions indicating imagerial strength.

No significant differences were found in the performance of students considered either highly verbal or highly imagerial on the basis of Paivio's IDQ (Paivio, 1971).

CHAPTER 5

Discussion

The results provide evidence suggesting that the dual-coding hypothesis can account for different amounts of information recalled and recognized from an AV production. Dual coding was testing by utilizing single and dual modes of presentation. The materials' memorability was shown to be related not only to the mode of presentation, but also to the familiarity level of subjects with the material.

Results of the study are considered below, presenting supporting data for the experimental hypotheses, followed by an interpretation of the outcome. Finally, the study is summarized in the form of conclusions and implications drawn for its applicability to instructional design.

The Dual-Coding Hypothesis

As indicated in the rationale, the dual-coding hypothesis refers to an imaginal (pictorial) and to a verbal (linguistic) coding system which can operate both independently and interdependently (paivio, 1978a). Media literature reviewed in Chapter 2 dealt with the use of audio and visual channels, and drew conclusions similar to Paivio's dual code but using media terminology. Both Paivio's theory and the media literature (e.g., Swyer, 1978) hypothesized an additive effect when verbal (audio) and imaginal (pictorial) information are presented simultaneously.

In order to discuss the predicted interactions among the experimental variables, the following approach is utilized. Both the modality and

abstractness factors were crossed within the between-subject familiarity factor (graduates, undergraduates, and education students), and are thus discussed below in interaction with familiarity. Immediate and delay tests are also considered in each section. Finally, free recall and recognition processes are implicated in each section as the dependent variables, with reference to both their similarities and differences.

Modality and familiarity effects: free recall. The single most critical test of dual-coding as it applies to AV materials was the predicted differential recall of auditory, visual and audio-visual information. As expected, overall recall of information presented in two modalities was significantly higher than recall of information presented via only one channel. Also as hypothesized, learners with higher levels of familiarity were better able to integrate the dual coded information than learners with little prior knowledge. Figure 1 represents graphically the inability of the education students to benefit as much from the generation of a dual code, probably due to stimulus complexity and/or channel overload (Hsia, 1971).

Somewhat unexpectedly, all three groups performed in a remarkably similar fashion on the single channel items. The high familiarity groups were still expected to outperform the education subjects. Perhaps the saliency of the high recall AV items in the high familiarity groups suppressed the overall retrieval of single modality information

down to the level of the education students, who were less able to ascertain the relative meaningfulness of individual ideas. The superior overall recall of the graduates and undergraduates was therefore attributable solely to the interaction between the learners' level of prior knowledge and the dual channel idea units. These data alone provide a persuasive argument for the utilization of two modalities, at least for sophisticated learners, and match a dual coding explanation. Furthermore, free recall has been found to be more dependent upon verbal, as opposed to nonverbal, symbolic systems (Paivio, 1971, p. 199), yet correspondent visual aids played a crucial mediational role in overall learner performance.

Modality and familiarity effects: recognition. Recognition tests require only partial information about items in order to respond correctly, while partial information may not be enough to guarantee correct free recall (Tversky, 1973). Different results between the free recall task and the recognition test are thus seen as dependent on the task demands imposed by the test instrument rather than on the experiment itself and/or factors due to the experimental procedure. Specific to imagery, Paivio (1971) has pointed out that recognition memory is particularly sensitive to the effects of perceptual variables, such as distinctiveness, and perceptual processes, such as imagery (1971, p. 182). The modality effects seen in Figure 4 would therefore appear at odds with a dual-coding account in that the AV recognition items were not as well identified as the single-coded

visual items for the high familiarity groups. However, under the present circumstances, two alternate hypotheses apply which predict precisely the results obtained: the familiarity (or frequency) increment hypothesis, and the associative interference hypothesis (Paivio, 1971). Essentially, both alternatives maintain that concepts (words, pictures, statements) suffer a negative effect in recognition tasks because they are less distinctive than newer, recently presented concepts (Shepard, 1967). In the present study, familiarity was varied across rather than within subjects, unlike the word list studies of Shepard. Nevertheless, the same negative effect occurred, and only for the high familiarity groups. No difference in performance was found in the low familiarity groups, as predicted by the above-mentioned hypotheses. (This study makes no attempt to choose one alternative hypothesis over the other). The superior performance on visual items demonstrated by the high familiarity group would be accounted for by the characteristic memorial distinctiveness displayed by pictures (Paivio, 1971). AV items would rank next with assistance from the visual correlate, and auditory items should appear least unique, thus, most susceptible to interference effects.

Finally, the interference hypotheses are relevant only to the recognition of recently (within one hour) presented items. One would therefore expect a relative improvement in associative discrimination as the interfering quality of the novel items dissipates. Despite

the typical decrement in scores over a one-week delay, as was found in free recall, learners were able to recognize items significantly better over the time lapse, again in confirmation of an interference interpretation. Test/retest improvement was highly unlikely both because of the complexity of the test, and the absence of any corrective feedback or intermittant instruction on the content (Kulhavy, 1977). These data therefore yielded exactly the combination of effects demonstrated by Shepard (1967) and others, in sharp contrast with free recall performance.

The qualitative differences among the familiarity levels along the modality dimension were again demonstrated in the test of learners' ability to identify the media or medium in which the recognized items were presented. It has been argued that students with greater prior knowledge should be capable of both encoding and storing more complex information. The high familiarity students were thus expected to identify the mode of presentation more accurately than low familiarity subjects. In spite of the poorer overall recognition performance by the graduate accountancy students, they were able to correctly identify the mode of presentation more often than education students. In addition, AV items were correctly identified significantly more often than either audio or visual items. The high familiarity students were thus able to encode more complex information, as stipulated earlier, and did so far better with items stored via dual coding. The low familiarity learners, on the other hand, were able to discriminate

better, but were less able to attach additional information to the already sufficiently complex stored unit. Interestingly, there was no overall decrement in performance over the one-week delay, suggesting that the source of a stimulus input is encoded along with the item itself, a finding in agreement with propositional theories of memory (Anderson & Bower, 1973).

The pattern of predicted versus obtained dual coding effects in concert with interference theory is decidedly appropriate in accounting for the familiarity by modality interactions. The abstractness of idea units, also examined in the present study, provided additional support for dual coding. This issue is covered in the next section.

Abstractness and familiarity effects: free recall. The association between concept abstractness and memorability is empirically well established, and has been interpreted as a product of a dual coding process (Paivio, 1974). The present study examined idea unit abstractness, and confirmed the hypothesis that concrete items are recalled and recognized significantly better than abstract items across all three familiarity groups.

The free recall abstractness by familiarity interaction as represented in Figure 3 occurred in line with a dual coding explanation. Only the absence of significantly lower abstract recall on the part of education students was unexpected. A floor effect, however, deemed such an interaction virtually impossible, as the unfamiliar learners recalled

practically no abstract information whatsoever, also as predicted. The familiarity group differences were nevertheless clearly present, with high, medium and low groups outperforming one another, respectively. Again, the floor effect in the low familiarity group yielded no difference between abstract and medium items, thus creating the interaction, with similar results in the graduate learners.

Abstractness and familiarity effects: recognition. The recognition test results proved equally predictable when the effects of the interference hypotheses discussed earlier were applied. As can be seen in a comparison of Figures 4 and 5, the results are remarkably similar in pattern. Education students again outperformed the higher familiarity groups, particularly with abstract items. Delay test performance again outstripped immediate testing. It is important to note, here, that the modality and abstractness results are not similar because their item pools were identical (e.g., abstract items tended to be presented auditorily, and so on). The correlation between a given abstractness rating and a given mode of presentation was r= .07, thus making the modality and abstractness variables independent.

The abstractness results did differ from the obtained modality effects in that the position of the three abstractness levels remained stable on both recognition and recall. These data are, however, consistent with earlier interpretations for two reasons. First, abstractness, unlike modality, was determined by and applied to each

group separately. A concrete concept can be established as such only within a relatively homogeneous population. This method for determining concept abstractness leads directly to the second reason: Abstractness and meaningfulness are closely related, such that items identified as concrete tend to be more meaningful than those rated by a group to be abstract. Pictures are generally found to be more concrete, ergo meaningful, and are also easier to discriminate. The results of the modality interaction would therefore necessarily implicate a visual (picture)/concreteness relation, with the accompanying effect of distinctiveness; or precisely the results obtained (i. e., concrete > medium > abstract).

When the effect of familiarity was allowed to interact with the abstractness results, it is apparent that the graduate learners were able to utilize the dual-coded AV materials to some extent, to concretize and thus make meaningful, the individual idea units (Anderson et al., 1976). However, as Simon and Siklossy (1972) and others have maintained, "experts" in any given area attempt to chunk information into retrievable categories, and aquire new information by organizing concepts into flexible schemata.

In generating these information "chunks", the graduates suffered a significant loss of incidental information, or at least its distinctiveness. However, their response confidence on correctly recognized information was higher than that of education students. Dual-coding may therefore facilitate critical retention, but interfere with less important ideas. Learners with little or no prior knowledge, on the

other hand, attempt to make discrete and memorable whatever they can, even though the toll of long term recall is usually high. It may be that high and low prior knowledge learners therefore utilize visual information as employed here in an essentially different fashion. The graduates are likely interested in and capable of using the visual code to organize and synthesize, while the education students can only attempt to discriminate and analyze. The recall/recognition differences provide tentative support for this, though more precise research comparing expert versus novice learning strategies with AV materials must be done to draw substantive conclusions.

Abstractness and familiarity effects: pictures. An attempt was made to apply an abstractness level to pictures, but the results were generally inconsistent in a three way interaction. The small n size made the interpretation of data difficult, or spurious.

Overall recognition of pictures was at about 75% accuracy, far superior to verbal recognition, as has been observed by other researchers (e. g., Fleming & Sheikhian, 1972; Paivio & Csapo, 1973). Pictures are salient and most easily discriminable, and are less appropriately labeled "abstract". They are therefore seen to be least affected by interference theory (Cunningham, 1972).

The picture analyses provided expected familiarity effects, with accounting graduates and undergraduates outperforming education undergraduates on both presented and non-presented pictures correctly recognized (see Figure 6). These results also neatly fit the

familiarity increment hypothesis. It was concluded that if more critical information had been presented in the visual-only mode, both more stable data and perhaps superior overall recall would have been observed.

Educational Implications

Instructional designers concerned with the planning and production of effective learning materials should be aware of the dual-coding process of information. While it is recognized that the encoding of complex symbolic information is as varied as there are learners, several unique guidelines for group presentations have been identified.

Learners with minimal prior knowledge of a topic must be treated differently from those with a solid knowledge base. The present data have demonstrated that for novices, any AV presentation must take special care not to overload the learner's processing capacity. The education students were not able to benefit from the multi-channel AV items, but performed as well as the experts on single channel idea units. Therefore, complementary (overlapping) audio and visual input will substantially benefit learners with prior knowledge, but overwhelm the newcomers. The dual-coded information may also have provided the graduates with organizing structures, suggesting that presentations for new learners may benefit from the inclusion of more explicit organizational strategies, and provide successive rather than simultaneous information deliveries. Following

the implications of Anderson et al. (1976), successive presentations may be enhanced by the use of short, concrete examples. However, symbolic vehicles which alleviate the effect of stimulus interference, such as more explicit pictorial representations of the desired concept or principle, are required by high familiarity students. This technique should help individual units of information to retain distinctiveness, or be organized under a unifying structure which does not obliterate them.

For all learners, the use of pictures is widely recomended. Picture memorability was shown in this study to be extremely high. Visuals are easily discriminable, unambiguous and attractive to the learner, as well as more concrete than verbal information usually is. However, the use of pictures should vary with the entry skills of the target population. Clearly, more research on presentation topic and task demand must be done to extend the above recommendations into the field.

In summary, well planned redundant audio-visual programs are effective instructional tools as long as special care is taken, to account for prior knowledge differences among different groups of learners. Two codes are better than one; when applied appropriately. Enabling the learner to retrieve information is best served by making concrete and familiar that which was previously not, and by ensuring that the learner has a familiar structure upon which to attach the new information. If none exists, instruction must first construct it, if comprehension, application, and synthesis are to be realized.

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APPENDICES

Appendix A

Norming Task Instructions

INSTRUCTIONS

Rather than have you now recall everything you have learned from the presentation, we would like you to use the content to make judgments about the materials. This is a critical task which will provide information about what those who do recall the materials will remember. Please note that others in the room will be working on different materials, so please attend to your work only.

The task which we would like you to perform is a rating task. On the following pages, you will find a number of sentences containing a complete idea, and a number of pictures also representing ideas. All of the ideas come directly from the presentation you have just seen.

For each sentence or picture, please indicate on the scale provided how concrete or abstract the idea is. By concrete, we mean that the idea is somewhat specific, something which you can easily construct a picture of in your mind. For example, a statement regarding the telephone as an effective means of communication is very concrete. By abstract, we mean something more general, something which is very difficult to picture, or make a mental image of. A statement concerning the gross national product may be very vague and abstract to most people. Note also that some ideas in accountancy, and indeed those which appeared in the presentation, will be very clear and concrete for you, but very abstract to others. We are looking for your considered, though subjective, opinion. There is no right or wrong answer. You will have a better idea of the range from abstract to concrete once you have completed the first few items.

in the case of intercompany transactions involving parent and subsidiaries, the majority shareholders' share of gains or losses must be eliminated,/ as well as the minority shareholders' share of any effect the higher fair values of investee assets may have on depreciation and amortization booked./ The separation of investor equity in the consolidated entity from the claims of the minority interest in the investee is accomplished by a balance sheet presentation of the minority interest as a creditor claim/ rather than as part of shareholders' equity./

Under the parent company extension approach, the consolidated statements are still intended for the use of the majority shareholders/ and the minority shareholders are considered to be outside the proprietary group./ In addition to recognizing the book value of the minority shareholders' interest, as in the parent company approach, the extension approach also recognizes the minority shareholders' fair value for the identifiable assets and liabilities of the investee./ When the purchase price of the majority shareholders' interest exceeds the fair values of net assets, the value of the investor's share of goodwill is being measured./ However, the goodwill for the minority interest is not being measured./ To summarize this approach, the consolidated balance sheet includes the total book values of the investee's net assets,/ the total fair values of the investee's net assets/ and excess of purchase price over the parent company's share of fair values of the investee's net assets./ Minority interest is measured by its share of the fair value of net assets./ When

intercompany transactions take place, a 100 per cent elimination of all resulting gains or losses is advocated./ The minority interest increases or decreases by complete elimination of unrealized profits or losses on sales by the investee to a member of the economic entity, and by its proportionate share of the income or loss as reported by the investee,/ adjusted for depreciation or amortization on any difference between book and fair values of the investee's identifiable net assets./ From the point of view of majority shareholders, the minority interest share of the investee-company's income is deducted from the total income of both majority/ and minority shareholders./ On the consolidated balance sheet, minority interest is shown between liabilities and shareholders' equity./

Under the entity approach, all assets and liabilities belong to the entity,/ and net income accrues to the entity./ Accounts and transactions are classified and analyzed from the standpoint of the entire enterprise as an operating unit/ and consolidated financial statements reflect this point of view./ Therefore, majority and minority interests are treated in the same manner./ Irrespective of the degree of ownership by the parent company, all of the investee's assets and liabilities are incorporated in the consolidated statement at their fair value,/ as in the parent company extension approach./ In addition, here, goodwill is also allocated proportionately./ Minority interest therefore includes fair values of identifiable net assets and goodwill./ The basic assumption being made under this approach is that the process of acquiring a majority interest in the

investee establishes a fair value not only for the majority interest portion/ but for the investee company as a whole./ Changes in the minority interest are determined as in the parent company extension approach./ All realized and unrealized gains or losses resulting from intercompany transactions are eliminated./ Because consolidated net income is the property of the entity,/ and since the minority interest in the investee is part of the total consolidated equity capital,/ consolidated net income is a combination of the incomes of majority and minority interest./ On the balance sheet, the two interests are shown within shareholders' equity as the two principal classes of owner equities./

In the final analysis, all of the presented approaches are viable alternatives to the preparation of a consolidated financial statement./ The chosen approach will be the one which best fits the needs of the user/ and provides the most useful information./

Appendix B

Recognition Test Instructions

RECOGNITION TEST

INSTRUCTIONS

Now that you have completed the free recall section, we ask that you carefully answer the following section for critical additional information. On the following pages you will find a number of sentences containing complete ideas, and a number of pictures also representing ideas. Some of the sentences and pictures come directly from the presentation you were just shown, while some were not presented.

For each sentence (item), please indicate if the idea was presented in the sound/slide presentation or not. The example below will demonstrate how to respond. If the idea was not presented, please indicate, based on your own knowledge, whether the idea itself is true or false. Note that any idea which was presented is necessarily true. After you have checked (✓) "Presented", or "Not Presented", and circled "T" for true or "F" for false, please indicate on the scale immediately below how confident you are of your response. Number five (5) means very confident; you are sure you are correct. Number one (1) indicates that you are not at all sure, or that you are just guessing. The numbers in between represent varying degrees of confidence.

Next, if the idea was presented, please try to recall and indicate in what modality; that is, check (✓) "Audio" if you just heard it, check "Visual" if you just saw it, and check "Audio & Visual" if you remember both seeing and hearing it.

GO TO THE NEXT PAGE

Complete the following item as a quick example:

There are four approaches to the preparation of consolidated financial statements.

___ Presented ___ Not Presented (If not, is it T or F)

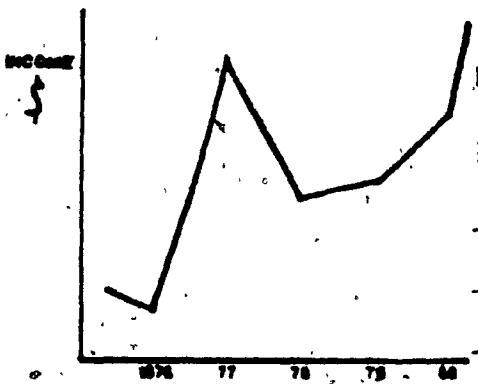
Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? __ Audio __ Visual __ Audio & Visual

Chances are that you remember this idea from the presentation, even though it was not stated exactly like this in the original -- the idea was there! Therefore, you would check "Presented" and, depending upon your confidence, circle the, say, (5) on the scale. If you thought it was there but were not positive, you may have checked "Presented" and circled (3) on the scale. You will note that the scale is relabeled "Low" at the "1", and "High" at the "5" on the first item of each page for quick reference.

For the pictures, again please indicate whether it was or was not presented, and rate the confidence of your response on the scale as above. If the picture was presented, please describe very briefly in the space provided what the idea represents.

Again as a short example, answer the item below:



___ Presented ___ Not Presented

Low 1 2 3 4 5 High
Confidence

If presented, What does it represent?

_____

_____

_____

You probably remember this picture from the presentation. If so, you should have checked "Presented", and circled your degree of confidence on the scale. It was used in the context of income measurement.

Please work through the entire booklet, completing the items in the order in which they appear - quickly but carefully. Once you have answered all the items, feel free to review your work. Remember that because you are indicating your confidence separately, every item can be answered , even when you are just guessing!

Please do the very best that you can, and answer each question (all parts) as accurately as possible.

If you have any questions at any point, please raise your hand.

CONTINUE ON THE NEXT PAGE

Appendix B

Recognition Test

1. The lower the value of minority interest reflected on the Consolidated Financial Statements, the higher the amount of net income accruing to proprietors.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

2. Consolidated Financial Statements prepared according to the entity approach include all three components of the purchase price, both for the majority and for the minority shareholders.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

3. Under the parent company approach, minority shareholders may own a small part of one or more subsidiaries, but not part of the parent company.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

4. As under the parent company extension approach the entity approach requires the presentation of minority interest as a one line item between liabilities and shareholders' equity.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

5. Consolidated Financial Statements prepared according to the parent company extension approach include the total book values, total fair values and only the parent company's share of goodwill.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

6. Being considered outside the proprietary group means that minority shareholders' interest always reflects only their proportion of the book value of the investee's net assets.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

7. CP Air, CP Hotels, etc. are divisions of Canadian Pacific.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

8. Owning 5% of Steinberg means ownership of 5% of Ivanhoe and Miracle Mart.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

9. Dome Mines is a subsidiary of Dome Petroleum.

___ Presented ___ Not Presented (If not, is it T of F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

10. Consolidated Financial Statements are useful in the preparation of the entity's income tax returns.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

11. Consolidated Financial Statements are used in the case of two or more legal entities which form one economic entity.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

12. The concept of minority shareholders is introduced in situations when the parent company owns less than 100% of the shares of its subsidiary.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

13. The purchase price of the majority interest is equal to fair value of their proportionate share of the investee's net assets and goodwill.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

14. Under all four approaches, it is assumed that the parent company's interest can not be dissociated nor shown apart from that of minority shareholders.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

15. Any goodwill recognized in Consolidated Financial Statements is an arbitrary amount estimated by management and calculated on the basis of a precise, mathematical formula.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

16. The most important factor in decisions concerning diversification is the requirement that the new acquisition be in the same industry.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

17. On a Balance Sheet prepared according to the parent company approach, minority interest is presented as a creditor claim rather than as part of shareholders' equity.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

18. The value of majority and minority interest has three components.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

19. The proprietary approach takes into consideration the book value, excess fair value and goodwill pertaining to the investee's net assets, for the prorpietor only.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

20. Proprietary approach ignores the minority interest completely.

___ Presented ___ Not Presented (If not, is it T of F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

21. Under the parent company approach, the shareholders' equity accounts of the parent company and those of the consolidated entity are identical.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

22. One must understand the concept of a subsidiary in order to understand the third type of diversification.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

23. The ownership of part of the parent company means ownership of similar percentage in each of the parent company's subsidiaries.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

24. Consolidated Financial Statements are not necessary for types A and B of diversification.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

25. Under the entity approach, the consolidated net income belongs to the enc and it is a combination of the incomes of majority and minority interests.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

26. Brascan is a subsidiary of Edper.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

27. The balance sheet prepared according to the entity approach presents majority and minority interests as two separate classes of owner equities.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

28. Book values of the investee's net assets are reflected in the Consolidated Financial Statement prepared under all but the proprietary approach.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

29. The parent company approach recognizes the book value of the minority shareholders' share.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

30. Steinberg and its subsidiaries, Miracle Mart and Ivanhoe, form one single economic entity, but each of them continues to exist as a separate legal entity.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

31. A subsidiary is a company in which another company owns directly or indirectly through other subsidiaries a majority of shares carrying the right to elect at least a majority of the board of directors.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

32. The value of minority interest in Consolidated Financial Statements prepared under the parent company extension approach is identical to that reflected under the parent company approach. The two approaches differ only in the amounts of net income (or losses) from intercompany transactions that are being eliminated.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

33. When two legal entities are kept separate and are maintained as two separate economic entities, the investor has a minority interest in the investee.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

34. When establishing a purchase price for the majority of the subsidiary's shares, the parent company always establishes a value for the minority interest.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

35. Technical developments in communications and transportation have facilitated the purchase and control of different companies scattered around the world.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

36. Under the parent company approach the portion of net income or loss from intercompany transactions being eliminated equals the amount being eliminated under the proprietary approach.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

37. Recognition of minority shareholders' goodwill is essential under the parent company extension approach.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

38. Under the proprietary approach the entity's net income does not include the proprietor's share of any gains or losses resulting from transactions between parent and subsidiary.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

39. The Parent company approach assumes that minority shareholders are part of the proprietary group and thus the Consolidated Financial Statements reflect their share of goodwill.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

40. Minority interest is shown on the Consolidated Balance Sheet as a one line item between liabilities and shareholders equity.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

41. One of the differences between the proprietary approach and the parent company approach is the fact that the parent company approach considers the majority shareholders as the owners of an undivided interest in the net assets of the subsidiary and not as the only owners of these assets.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

42. United technologies is an example of a company which diversified into other industries such as airplanes, elevators, computers and trucking.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

43. In the case of less than 100% ownership of a subsidiary there are four approaches as to how to calculate the interest of minority shareholders.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

44. The parent company extension approach considers the minority shareholders to be outside the proprietary group, but recognizes the book value and the excess fair value of the minority shareholders.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

45. As with the proprietary approach, under the parent company approach Consolidated Financial Statements are prepared primarily for parent company shareholders.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

46. There are three types of diversification.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

47. Under the proprietary approach, any changes in the assets, obligations or net income of the entity accrue proportionately to each shareholder.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

48. Preparation of a Consolidated Financial Statement in the case of a wholly owned subsidiary is straight forward.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

49. The entity approach treats majority and minority shareholders in the same manner.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

50. An overabundance of funds forces a corporation to acquire shares of other companies.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

51. Tough anti-trust legislation encouraged diversification.

___ Presented ___ Not Presented (If not, is it T or F)

Low 1 2 3 4 5 High
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

52. Under the entity approach no portion of the net income accrues to the entity's proprietors.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

53. A company's share in a subsidiary's assets, is considered part of the company's assets and therefore a source for income.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

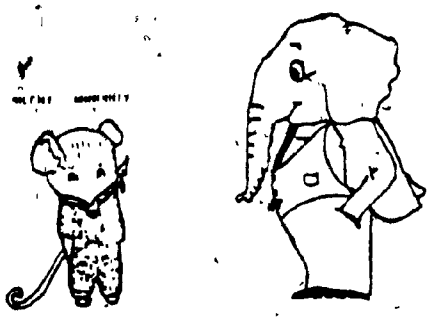
If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual

54. The four approaches to the preparation of Consolidated Financial Statements are proprietary, parent company, commander theory, and entity.

___ Presented ___ Not Presented (If not, is it T or F)

1 2 3 4 5
Confidence

If Presented, in what modality? ___ Audio ___ Visual ___ Audio & Visual



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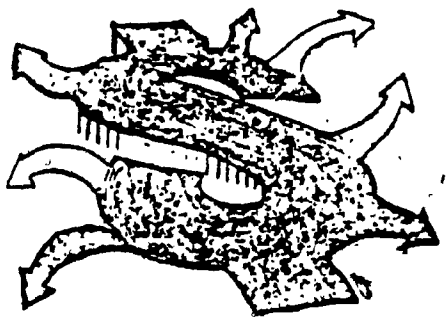

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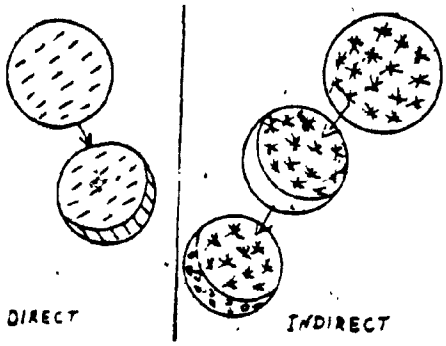

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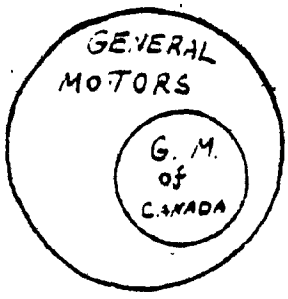


___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

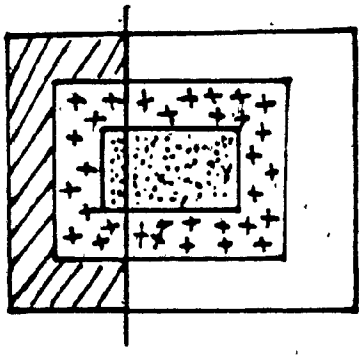
If presented, what does it represent?

PURCHASE PRICE = 100% / $ X

___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

If presented, what does it represent?



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Low 1 2 3 4 5 High
confidence

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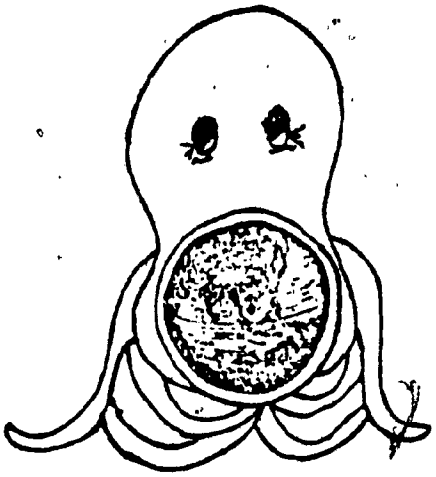

___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

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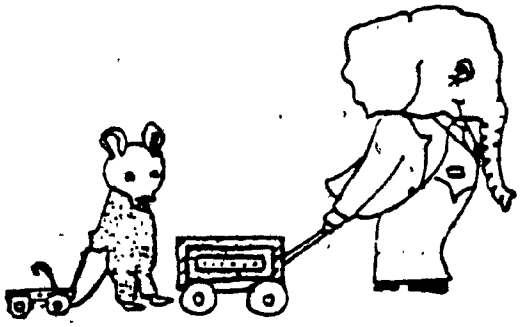

___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

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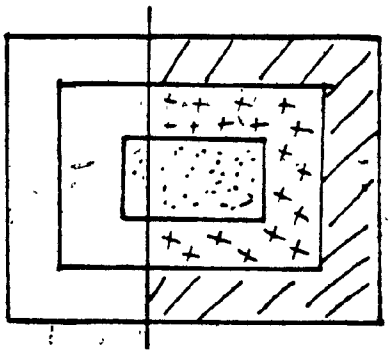

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Low 1 2 3 4 5 High
confidence

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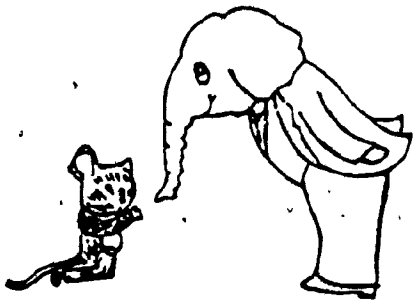

____ Presented ____ Not Presented

Low 1 2 3 4 5 High
confidence

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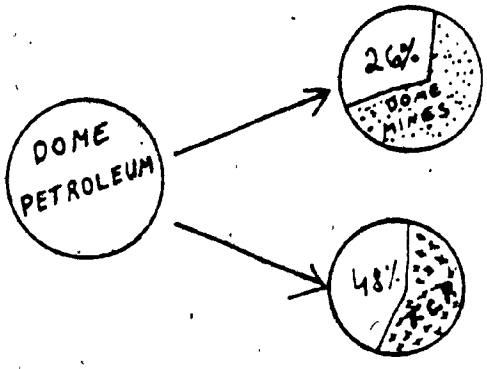


____ Presented ____ Not Presented

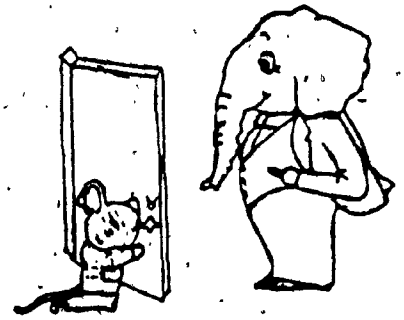
Low 1 2 3 4 5 High
confidence

If presented, what does it represent?

____ Presented ____ Not Presented

Low 1 2 3 4 5 High
confidence

If presented, what does it represent?



___ Presented ___ Not Presented

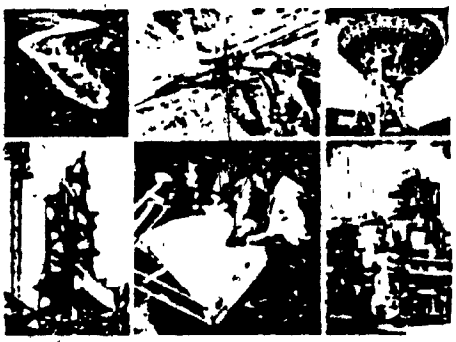
Low 1 2 3 4 5 High
confidence

If presented, what does it represent?

___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

If presented, what does it represent?



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confidence

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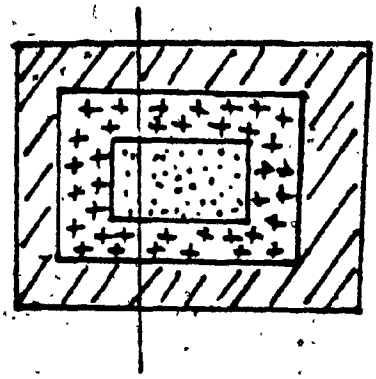

___ Presented ___ Not Presented

Low 1 2 3 4 5 High
confidence

If presented, what does it represent?

Appendix C

General Instructions

STUDENT #: _____

AGE: _____ SEX: M F

GENERAL INSTRUCTIONS

This is an exercise to see both the amount and kinds of information people learn from an audio/visually presented instructional unit. In a few moments, you will be shown a sound-slide presentation on a topic in accounting theory. Please watch and listen to it very closely, as you will be asked to write down as much as you can remember from the presentation once it is over. Because it is very important that you comprehend and recall as much information as possible from both the slides and the tape, we ask you not to take notes, as it will distract you.

We will give you further instructions immediately following the presentation. For now, please simply attend to the content and learn as much as you can for later recall.

Thanks for your help and cooperation!

Are there any questions at this point?

Appendix C

Free Recall Instructions

INSTRUCTIONS

On the following pages, please write down everything and anything you can remember from the presentation. Feel free to write it in the format you prefer, whether it be an outline, point form, essay description, whatever. Also feel free to use the space at the bottom of the page or the back of the page to include illustrations or any other type of notation which reflects what you learned from the presentation. Individual words, sentences, ideas and concepts, pictures, interrelations are all appropriate. Basically, we want you to record everything you remember within a reasonable time frame. Please work as quickly and accurately as you can, but don't leave anything out. You will have about ten minutes, but keep working until we ask you to stop. If you run out of ideas before the time is called, look over what you have already written, and make any necessary corrections and additions. Please use the full time allotted!

If you have any questions regarding what we would like you to do here, please feel free to ask by simply raising your hand. We will come to you. Note that others in the room may be working on a different task, so please attend to your work only.

Thanks!

TURN TO THE NEXT PAGE AND BEGIN

Appendix D

Biographical Questionnaire

QUESTIONNAIRE

Circle the correct response and write in added comments.

1. How familiar were you with the overall content of the presentation before today?

   (a) Very familiar (b) Familiar (c) Knew some of it

   (d) Somewhat unfamiliar (e) Very unfamiliar

   Why is that so? (Did you cover it in class, read it somewhere, etc.?)

   _____

   _____

   _____

2. Have you ever taken any courses in accounting?

   (a) YES (b) NO

   If you have, please list them:

   _____

   _____

   _____

   _____

   _____

   _____

THANK YOU VERY MUCH FOR YOUR HELP AND COOPERATION!!

Appendix E

Norming Data