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ABSTRACT

This paper summarizes the theoretical basis of the relationship between preconceptions and the construct of mental effort in order to identify factors that researchers have shown to influence mental effort, and to suggest an agenda for future research in this area. It begins with a discussion of the theoretical bases of the relationship between preconceptions and mental effort which reviews and summarizes four theories of cognition and motivation: (1) reactive theory; (2) active processing theories; (3) curiosity theory; and (4) attribution theory. It is also noted that past experiences, perceptions of the task, and characteristics of the media may each contribute to the preconceptions that learners bring to an instructional setting, and may in turn influence the invested mental effort. The paper then describes research on preconceptions and mental effort in the specific areas of learner preconceptions; mental effort and learning; the influence of the perceived task on mental effort; and the influence of characteristics of the media on mental effort. The paper concludes with suggestions for future research, which include measuring the delay time in responding to some secondary task while attending to the primary task of reading or viewing the stimulus material; studying the role of embedded post-questions in text using a secondary task technique to measure the amount of cognitive capacity used during processing; and using other methods to increase the cognitive capacity used in processing a text-based lesson. (38 references) (CGD)

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Factors Influencing Mental Effort: A Theoretical Overview and Review of Literature

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A Theoretical Overview and Review of Literature

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Factors Influencing Mental Effort: A Theoretical Overview and Review of Literature

Several researchers (Krendl & Watkins, 1983; Salomon, 1984; Salomon & Leigh, 1984) have suggested that the learner's preconceptions of a medium are an influential factor in achievement. For example, Salomon found that learners perceive television as easier than print and they report investing more mental effort and learn more from a text-based lesson. Winn (1985), Hannafin (1985) and Clark (1983) have recently called for an investigation of the ways in which different forms of media are perceived and how these perceptions influence mental processing.

The purpose of this paper is to summarize the theoretical basis of the relationship between preconceptions and the construct of "mental effort", to identify factors that researchers have shown to influence mental effort and to suggest an agenda for future research in this area. General areas relevant to an examination of mental effort include 1) cognitive processing theory, 2) motivation theory, and 3) specific research on mental effort. Particular emphasis will be placed on studies that investigate the processing of video-based instruction.

Theoretical Basis of the Relationship between Preconceptions and Mental Effort

Salomon (1983a) defines the construct of "mental effort" as the "number of non-automatic elaborations applied to a unit of material" (p.42) and uses the construct to refer to the motivational and cognitive aspects of information processing. The conscious, effortful processing that results from increased mental effort is assumed to make more contact with the learner's mental schemata, leaving more memory traces and facilitating the retention of the material. An examination of cognitive and motivational theory may suggest ways that learners' preconceptions are related to the mental effort expended when processing a mediated lesson.

Cognitive Theories

Several theories have been offered to explain the cognitive processing of video-based materials. One set of theories present the viewer as passively involved in the viewing experience. Proponents believe that the degree to which a person attends to the video effects the level of comprehension (Singer, 1980). In contrast, proponents of various active processing theories contend that attention results from the need to fill slots in schemata with expected information (Anderson & Lorch, 1983).

Reactive theory. In the reactive theory of television viewing, television is seen as eliciting and sustaining attention through salient formal features such as quick movement, quick cuts, and sound (Anderson & Lorch, 1983; Singer, 1980). Singer (1980) further developed this theory and proposed that, due to constant visual and auditory changes, television creates a continuous series of orienting responses. According to Singer, a heightened awareness, or orienting response, occurs whenever a person is presented with any new or unexpected stimulation; once the new information can be assimilated into a preestablished schema, a person quickly habituates to the situation in order to be ready to respond to other new stimuli in the environment. Singer attributed television's appeal to the viewers' inability to habituate to the televised stimuli and the resulting pleasure that is derived from small doses of novelty. With the constant appearance and reappearance of characters on television, the viewer must continually attempt to orient to the information presented and therefore continues to attend to the program even if no longer interested.

The viewer is influenced by the video program and, as such, the viewer's plan intentions, and strategies are perceived as exerting a minimum of influence. Comprehension is seen as following from attention, and in fact, the information retained is considered to be at a low level since "pressures of attention to novel stimulation can actually interfere with our ability to store" information (p. 38). He concluded that television viewing as a passive cognitive activity "will yield considerable recognition memory without efficient retrieval" (p. 42).

Active processing theories. This view is in marked contrast to the active processing theories (Anderson & Lorch, 1983). Active processing theorists contend that viewers are instead extremely well "habituated" to television viewing, and that habituation, or well established scripts, may inhibit the active processing of video-based instruction. Theorists assume that viewers develop expectations about the temporal and conceptual flow of television programs through experience. These expectations are part of a viewing schema that guides the viewer in comprehending the video program.

Active processing theorists propose that attention is maintained by the viewer's ability to answer questions posed by the schema. If all the "slots" dictated by the schema are filled, attention is terminated, or if the user is unable to call upon an appropriate narrative schema, attention is also terminated. (Anderson & Lorch, 1983). Whereas with the reactive theory, comprehension follows from attention, from an active processing viewpoint, the primary casual relationship is from comprehension to attention. The viewers' need to fill slots in their schemata guides their attention.

This notion of schema is similar to the concept of "scripts" promoted by Shank and Ableson (1977). Like schemata, scripts are made up of slots and requirements about what can fill these slots. But whereas schemata are broad organizational structures that include both concrete and abstract knowledge, a script is a type of schema that contains an individual's knowledge of an event sequence (Ableson, 1981). When an individual is presented with a situation with which he or she has previous experience, the individual then enacts a script that was written when the experience was new.

As an event-based cognitive structure, scripts play a double role in television viewing (Ableson, 1981) . One type of script is used for the understanding of the events seen on television and another type of script is used in the behavior of television viewing. A script-based understanding of the events involves the "cognitive retrieval of previous situations to which the present situation is similar" (Ableson, 1981, p. 719) and typically utilizes a type of script that Shank and Ableson (1977) refer to as a situational script. For example, when one scene in a television program presents the hero in his living room and the next scene shows him at a crime scene, most viewers do not assume that the crime scene and the living room are in the same location. The viewers' situational scripts provide the connecting events which may lead them to conclude that the hero left his living room and drove to the scene of the crime. Such situational scripts are critical to the comprehension of events that are viewed on television

But as a behavior, television watching involves an instrumental script rather than a situational script. Instrumental scripts are similar to situational scripts but instrumental scripts involve only one player, whereas situational scripts involve multiple participants (Schank and Ableson,1977). Although there may be several people present when an individual is watching television, the behavior of watching television is a personal act that requires only one participant. Instrumental scripts also differ from situational scripts in that the sequence of actions in an instrumental script is so fixed and uninteresting that the steps in the process may be forgotten entirely and all that is usually remembered is the goal. For example, if you were to ask learners what they do when they watch

TV, you would probably be told that they just "turn it on and watch". Because we can assume that most learners have had extensive prior experience with watching television, we can assume that learners have well developed instrumental scripts for such activities, however, the specific situational script engaged by the learner would depend on the learner's experience with the events depicted in the television program.

Langer and her associates (Langer, Blank, & Chanowitz, 1978, Langer & Imber, 1979) use the concept of mindlessness, rather than scripts, to explain habitual information processing in the face of familiar stimuli. In order to be processed mindlessly, a task or message must be overlearned and congruent with an individual's past experience. When the message appears to be familiar and fits in well with the individual's anticipatory schema, a routine for the activity substitutes for active processing and information perceived to be known is ignored.

The lack of conscious control over the performance of a task that is inherent in mindless behavior leaves the individual vulnerable to problems or errors in behavior. Based on Langer's theory, it seems likely that learners who are accustomed to television viewing as a recreational task would have difficulty modifying their performance in response to an instructional videotape

Mindlessness, scripts, and schemata are all theoretical constructs that place a great deal of emphasis on the role of prior experience. The more familiar individuals are with a task, the stronger their preconceptions of it. The stronger these preconceptions, or the more easily they are available to processing, the greater the probability that these preconceptions will guide the individual's response to the presented material. The extent to which preconceptions include beliefs or expectations about the amount of mental effort required by the task may affect the amount and nature of non-automatic elaborations of the material (Salomon, 1983b).

Motivational Theories

Salomon's (1981) concept of "amount of invested mental effort" (AIME) "is cognitive in the sense that it pertains to mental elaborations of information material. But as these elaborations are controlled, rather than automatic, their employment implies an measure of choice" (Salomon, 1983, p. 44). Because the individual must choose to engage in active processing, the construct of mental effort has motivational, as well as cognitive, components.

A cognitive view of motivation emphasizes the internal events that lead an individual to engage in an activity These internal events may include curiosity, uncertainty, causal attributions, and expectations for success (E Gagné, 1985) Berlyne's (1960) curiosity theory and Weiner's (1979) attribution theory seem especially applicable to the processing of a mediated lesson.

Curiosity theory. Although not directly concerned with the construct of mental effort, another cognitive theory of motivation may help to explain the increase in achievement, and presumably mental effort, that is so often found when content is presented in a novel manner. According to Berlyne (1960), when the learner experiences something that is novel, surprising, or complex, a heightened sense of arousal and uncertainty is produced. This aroused state leads to exploratory behavior in order to reduce the unpleasant feeling of uncertainty. As the learner gathers information, the uncertainty is reduced and the resulting reduction in arousal is reinforcing to the learner. Berlyne's theory may account for the increases in attention in response to televised excitement documented by the reactive theorist of television processing (Singer, 1980).

In addition to the perceptual curiosity that results from novel, surprising or complex stimuli addressed above, Berlyne (1960) also recognizes epistemic curiosity caused by thoughts, beliefs or attitudes that may be discrepant with prior beliefs.

Epistemic curiosity may be especially valuable, as questioning strategies may be utilized to create the cognitive conflict that results in increased exploratory behavior directed toward the reduction of uncertainty. In general, Berlyne's theory suggests that novel situations or cognitive conflict may result in a temporary increase in mental effort directed at reducing the uncertainty that is experienced when learners confront a stimulus that is inconsistent with their prior experience.

Attribution theory There is some research evidence that learners' attribute their success and failure in learning from print to different causes than they attribute their success or failure in learning from television (Salomon, 1984) According to Weiner (1979), the reasons that people give for a success or failure contributes to the mental effort that will be exerted in similar situations in the future. Weiner proposed that individuals attribute their success or failure to one of the four broad classes of luck, effort, difficulty of the task, or ability. The attribution provided in a situation of success or failure influences the extent to which the individual will persist at the task. Weiner contends that casual attributions for failure to unstable causes such as effort or luck increase task persistence more than attributions to stable causes such as ability or task difficulty Of the two attributions that increase task persistence, attributing a task outcome to effort results in the greatest task persistence since effort is under the control of the individual.

The perceived task difficulty is also thought to influence the amount of effort expended (Weiner, 1979). Although task difficulty is a stable cause beyond the control of the individual, it is instrumental in providing cues as to the efficiency of effort. Weiner contended that individuals seek to engage in tasks in order to gain information about their ability. Individuals seem to work best at tasks of intermediate difficulty because engaging in difficult tasks provides little information about their ability or effort expenditures and may be perceived as a waste of energy while easy tasks are perceived as unnecessary for success. When faced with tasks of intermediate difficulty, individuals that attribute success or failure to effort exert a maximum of effort since these individuals believe that the best performance strategy for high achievement in such situations is to try harder.

Salomon (1984) analyzed student attributions of success and failure in learning from print and television and found that students attributed success with television to external causes such as ease of material, and attributed success with print to the reader. Conversely, failure with television was attributed to internal causes such as lack of effort and failure with print was attributed to the difficulty of the material. It is interesting to note that learners attributed success and failure with print to stable causes, but they attributed failure with television to the unstable attribution of effort. As previously stated, Weiner (1985) has suggested that attributions of effort can result in the greatest task persistence since it is very much under the control of the learner. This study suggests that if learners can come to view television as worthy of the exertion of additional mental effort, or moderately difficult according to Weiner, then they will exert a maximum of effort

Summary of cognitive and motivational theory

A review of cognitive and motivational theory indicates that conscious and unconscious preconceptions such as scripts, schemata, attributions, and curiosity each seem to influence mental effort. According to cognitive and motivational theory, learner preconceptions are influenced by several factors.

Past experiences. Past experiences play a crucial role in the preconceptions that learners' bring to a learning environment. Learner scripts and schemata are abstracted from prior experience and extensive prior experience may result in overlearning and mindless behavior.

Perceived task. The particular script or schema engaged in response to a learning task is influenced by the perceived purpose of the task. Attribution theory also indicates that the way that the task is perceived influences the amount of mental effort engaged in processing a lesson.

Characteristics of the media. The characteristics of the media cue the learner as to the appropriate instrumental script to engage and contribute to the preconceptions that learners bring to an instructional setting. In addition, curiosity theory suggests that novelty and structural characteristics such as embedded questions may create cognitive conflict and result in a temporary increase in mental effort in order to reduce the internal conflict.

In summary, the learners' past experience, the perceived task, and the characteristics of the media may each contribute to the preconceptions that learners' bring to an instructional setting, which may in turn, influence the invested mental effort. Research that has examined some of these factors will be reviewed next.

Research on Preconceptions and Mental Effort

Salomon and Leigh's (1984) finding that high ability students perceived television to require less effort than low-ability students and performed poorer than low-ability students lends credence to the idea that preconceptions of the effort required to process a lesson influence achievement. In order to more closely examine the influence of preconceptions on mental effort, this section will 1) present the results of studies that surveyed learners' preconceptions of several forms of media, 2) examine the type of learning that is influenced by increased mental effort, then 3) examine studies that have manipulated the perceived task and the characteristics of the media to determine the effects on mental effort.

Learner Preconceptions

Since preconceptions of a medium have been shown to influence the mental effort investing the processing of a lesson, the way in which different media are perceived is of interest to an examination of the influence of preconceptions on mental effort. As reported earlier, Salomon found that learners' perceive television as easier than print (1983b,1984) and report expending less effort in learning from televised lessons than from print based lessons (1983b; Salomon & Leigh, 1984). These findings may result from the fact that most experience with reading has been for educational reasons and most experience with television has been for entertainment and that learners' instrumental scripts would reflect these prior experiences.

Krendl (1986) further examined students' preconceptions of print and television and expanded her examination to include computers and writing. Krendl found that students preferred computers to television, television to reading, and reading to writing. They felt that television was the least difficult, followed by, in order of preference, reading, writing and computers. They felt that they would learn more from reading, followed closely by computers. Writing was placed further down the scale, followed by television

Krendl notes that, in general, the more an activity is preferred, the less difficult it is perceived to be, and the less likely one is to think one will learn from it. Although her general conclusions were consistent with Salomon's work, students' preconceptions of writing and computers often contrasted with this general conclusion. Students rated writing as one of the more difficult activities, yet they rated it as low on the learning scale. Learners' preconceptions of computers also contrast with Salomon's findings that students tended to prefer

media that were easier, but were consistent with his observation that students felt they would learn more from a presentation that they believed to be difficult.

It appears that writing and computers differ from reading and television in important ways. Writing differs from television and reading in that writing involves the generation, rather than the encoding, of concepts and ideas. Like writing, computer use may also involve the active generation of concepts and ideas rather than the passive reception of information that is typical of reading and watching television. Even when computer use involves the encoding of ideas, as in computer-assisted instruction, it may still be difficult for learners to rate computer use along the same continuum as reading and television watching because computer-assisted instruction is a relatively new instructional strategy and students may have less predictable scripts for computer use.

Mental Effort and Learning

Some researchers (Krendl & Watkins, 1983; Salomon, 1983b; Salomon, 1984; Salomon & Leigh, 1984) seem to suggest that increased mental effort does not affect factual recall, but instead results in greater inferences. These findings indicate that attention may be sufficient for recall but not for higher level cognitive processing, which is consistent with reactive theories of television processing.

In addition to the evidence for an increased number of elaborations as a result of the increased mental effort exerted in text-based instruction, there is some evidence that the elaborations are of a different quality. Whereas children exposed to a video story base their inferences on visual information, students that had heard the story read aloud showed more evidence of inferences based on general knowledge and personal experiences (Meringoff, 1980).

According to schema theory, learners create narrative schemata from past experiences. Salomon (1983b) presented learners with a jumbled version of a videotape and found that although the learners that received a jumbled version of the tape reported more mental effort than learners that received a normal version of the program, the learners that received the jumbled version had lower achievement scores. Although Salomon (1983b) suggests that simply expending more effort does not guarantee increased inferences when learners are unable to fit the information into a preexisting schemata, when Krendl and Watkins (1983) conducted a similar study but kept the original narrative intact and added irrelevant segments, the learners attempted to fit the incongruent information into the story line. In the Krendl and Watkins study (1983), the availability of a main intact narrative apparently provided the structure necessary to tap into the viewer's narrative schemata. In Salomon's study, self reports of increased mental effort indicated that the learners did attempt to elaborate on the material, but, consistent with schema theory, their lower performance suggests that they may have abandoned the effort due to an inability to fit information into an existing schema.

The Influence of Perceived Task on Mental Effort

Several studies (Krendl & Watkins, 1983; Ksobiech, 1976; Salomon & Leigh, 1984) have attempted to manipulate students' perceptions of the task purpose in order to increase the amount of invested mental effort. The results of these studies show that students that are instructed to learn from a lesson exhibit more mental effort (Salomon & Leigh, 1984) and exhibit greater achievement (Krendl & Watkins, 1983; Salomon & Leigh, 1984) than students that are instructed to attend to a lesson for fun. In addition, it appears that the perceived purpose of the task also influences the modality (audio or video) that receives the primary attention when viewing a video tape (Ksobiech, 1976). For example, when instructed to pass an exam, subjects frequently sought information from the auditory channel Since

learners are very familiar with receiving the content on which they are to be tested through auditory channels, as in a classroom lecture, their increased attention to the auditory channel may reflect such scripts

The Influence of Characteristics of the Media on Mental Effort

The characteristics of the media have been suggested as an influential factor in the amount of mental effort invested in a learning task and one of the primary differences between text and televised instruction lies in the ability of the learner to control the pace, therefore, these differences may be offered as an alternative hypothesis to explain the increase in both number and kind of elaborations evidenced by students that received a print lesson. This alternative hypothesis was tested by Krendl and Watkins (1983). However, Krendl and Watkins found that students that were allowed to stop a videotape at any time they wished to ask a question, make a comment, and so forth, did not exhibit significantly higher scores on measures of recall and higher level processing than students that were not allowed to control the pace of the videotape, suggesting that student control of the pace of a video lesson does not significantly increase the amount of mental effort invested in processing a video-based lesson.

Summary

Preconceptions based on past experiences, perceived task utility, and media characteristics each seem to influence mental effort. Past experiences influence the scripts and schemata that individuals bring to the learning environment While of crucial importance, past experiences can not be easily altered by the researcher, teacher or instructional designer. However, learner expectations of the future usefulness of the information can be successfully manipulated. Researchers (Krendl & Watkins, 1983; Salomon & Leigh, 1984) indicate that students that are instructed to learn from a lesson exhibit significantly greater mental effort and achievement than individuals instructed to attend to a lesson for fun. In addition to manipulating the learner's perception of the goal of the task, the characteristics of the media may also be manipulated to increase the amount of invested mental effort. Although learner control of the pace of a video lesson did not seem to significantly increase achievement (Krendl & Watkins, 1983), there are other structural characteristics of video-based instruction that may be varied in order to increase mental effort.

Suggestions for Future Research

Several researchers (Britton, Glynn, Meyer, & Penland,1982; Burton, Niles, and Lalik,1986; Reynolds and Anderson, 1982; and others) have manipulated the structural characteristics of text materials and used a secondary task techniques to measure the amount of cognitive capacity used during processing the printed lessons. In these studies, subjects were told that comprehending the text was their primary task, but were also told to depress a key as quickly as possible following a given sound. This technique assumes that individuals have a fixed amount of cognitive capacity. When subjects are concentrating on the primary task of attending to the lesson, it is assumed that subjects will take longer to respond to the sound than in a baseline condition because there would be little cognitive capacity available to process the secondary task and, therefore, reaction time would be delayed until additional capacity became available This technique also assumes that there is a correlation between response time to a secondary task and the amount of mental effort, or cognitive capacity, in use at the time of the response.

It is interesting to note that in these studies, "cognitive capacity usage" has been operationally defined in a manner that is similar to Salomon's construct of

mental effort. Although this technique has not been used in studies of mental effort, Salomon (1984) has suggested that one way of measuring "amount of invested mental effort" (AIME) is by the delay time in responding to some secondary task while attending to the primary task of reading or viewing the stimulus material. Since cognitive capacity usage and AIME are operationally define in a similar manner in these studies, we can assume that the techniques that are shown to increase the amount of cognitive capacity used in processing would also increase AIME and achievement. An examination of studies that incorporate a secondary task technique to measure the amount of mental effort invested in a learning task may suggest ways that the structural characteristics of video-based instruction can be modified to increase the mental effort that learners invest in processing the lesson.

Embedded question

Several studies (Britton, Piha, Davis & Wehausen, 1978; Reynolds and Anderson,1982; and others) examined the role of embedded post-questions in text using a secondary task technique to measure the amount of cognitive capacity used during processing and may be of interest.

Reynolds and Anderson (1982) found that reaction times to a secondary task were significantly delayed when subjects were reading text segments containing information that was relevant to the questions as compared to segments containing question-irrelevant information. Britton and his colleagues (Britton, Piha, Davis & Wehausen, 1978) conducted a similar study using text-relevant questions, irrelevant question or no questions. They found than the cognitive capacity usage increased when questions that were relevant to the text content began but similar increases were not observed when irrelevant questions began or when no questions were provided. This study suggests that the increased cognitive capacity usage that results from embedded questions is due to some sort of content specific processing rather than an effect of the presence of embedded questions in text. Because the increase in reaction time to a secondary task was largest on pages immediately following the questions, Britton and his colleagues concluded that the increased cognitive capacity usage following the embedded questions indicates that the learners are engaging in elaborations of the content materials.

Although these studies did not examine cognitive capacity usage in response to embedded questions in video-based materials, Anderson and Biddle (1979) thoroughly reviewed the literature on embedded questions in studies that used film, lecture, videotape or text and found that the medium of presentation did not seem to matter much; questioning statagies affect the processing of text and video-based instruction similarly.

Several researchers have included embedded questions in video-based materials and measured the affects on achievement with mixed results. Some researchers (Heestand, 1980; Lipsky, 1983) have found that the inclusion of embedded questions yields greater achievement scores than the presentation of a video tape without embedded questions, while other researchers (Schaffer & Hannafin, 1985; Teather & March et, 1974) suggest that the embedded questions must be followed by feedback in order to effectively increase achievement Dalton (1986) suggests that requiring learners to actively respond to the embedded questions is even more effective than simply providing the learners with embedded questions and feedback. If learners do invest greater cognitive capacity in processing a lesson that includes embedded questions, increased in mental effort may account for the increases in achievement documented in these studies.

In future research, the incorporation of a secondary task technique as a dependent measure would allow researchers to determine if techniques, such as embedded questions, that have been shown to increase the cognitive capacity used

in processing text-based materials would also increase the mental effort invested in processing video-based lessons. Future research in video-based instruction should also explore the manipulation of other structural characteristics to determine ways that the learners' preconceptions of television as a passive medium can be overcome to result in increased mental effort and achievement

Other factors

In addition to the use of embedded questions, several other methods of increasing the cognitive capacity used in processing a text-based lesson have been investigated. A few of the techniques that would be appropriate for use with video-based instruction are briefly noted below.

INFORMING THE LEARNER OF THE OBJECTIVES: Students that were provided with specific learning objectives used more cognitive capacity when reading objective relative information than learners that were provided with general instructions to pay special attention to a particular section or learners that were provided with no learning objectives (Britton, Glynn, Muth, & Penland, 1985)

RELATING TO PRIOR KNOWLEDGE: Several studies (Britton, Holdredge, Curry, & Westbrook, 1979; Britton & Tesser, 1982; and others) suggest that learners invest more mental effort in processing lessons in which they have some prior knowledge of the topic. For example, when learners were presented with a passage that was meaningless without a title, the learners that read the passage with the title invested more mental effort in processing the passage than the learners that received the same passage without the title (Britton, Holdredge, Curry and Westbrook, 1979). It appears that the title may have made it possible for the learners to activate prior knowledge of the topic, and therefore, to engage in active elaboration of the content of the passage.

NARRATIVE VS. EXPOSITORY: Learners also seem to invest more cognitive capacity in processing narrative text than expository text (Britton, Graesser, Glynn, Hamilton, & Penland, 1983). Britton and his colleagues hypothesized that learners may be more familiar with narrative prose and, therefore, have better established schemata for narrative prose than for expository prose. The presence of well established schemata would allow the learners to elaborate on the content in more detail. The elaboration process would fill the learners cognitive capacity more completely and would potentially result in an increased number of inferences based on the content.

LEARNER EXPECTATIONS OF IMMEDIATE VS. DELAYED TEST: Britton (1980) found that students that expected a delayed test invested greater effort in processing the lesson than students that expected an immediate test. It is interesting to note that recall scores were similar for both groups, however, as previously stated, achievement gains from increased mental effort may not be evident on a test of recall.

Conclusion

This paper has attempted to review the current literature on preconceptions of media and on the relationship of learner preconceptions to the amount of mental effort invested in a learning task. It has been suggested that methods that increase the cognitive capacity used in processing text based lessons be investigated to determine their potential for overcoming learners' preconceptions of television as a passive medium requiring little mental effort.

Additional research that examines the relationship of leaner preconceptions of "newer" media (such as computers) to the amount of mental effort invested in the learning task may also be of value. Krendl (1986) has suggested that learner preconceptions of computers do not follow the pattern suggested by Salomon in his investigation of learner preconceptions of print and television, indicating that

further research is needed in this area. It is possible that learner preconceptions of "new" media may change as the learners engage in the process of becoming familiar with the media.

It is hoped that further research on the issues identified in this paper will provide valuable information that will have practical applications for the design of more effective video-based instruction.

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