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ABSTRACT

The primary purpose of this article is to review the literature on research studies conducted in the last five years on the effectiveness of window presentation strategies and the cognitive dependence status of field-dependent/independent (FD/FI) learners in a computer-mediated instruction (CMI). Secondary to this purpose is to summarize research findings which investigated the factors and the effects of CMI on the studies' populations. The literatures reviewed related to presentation strategies, cognitive styles, and academic achievement are summarized in terms of the following: presentation strategy and academic achievement; presentation strategy and time on task; cognitive style and academic achievement/performance; cognitive style and time on task; and implications for educational (instructional) technologists. (Contains 49 references.) (AEF)

The Effectiveness of Window Presentation Strategy and Cognitive Style of Field Dependence Status on Learning from Mediated Instructions

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Introduction

The early developments of computer-mediated instructions (CMI) (e.g., CBI/CAI, CBT, etc.) were based solely on behavioral models which did not consider individual differences in terms of aptitude or cognitive styles (Eysneck, 1993; Messick, 1976). The move toward the use of cognitive models has resulted in the need to find better cognitive-oriented methods of presenting information (Livingston, 1991; Rayner, 1992). A learner's cognition is enhanced more in a self-regulated learner-controlled learning environment than in a self-regulated program-controlled computer-mediated one (Tombaugh, Lickorish, & Wright, 1987; Young, 1996).

Computer-mediated instructional designers are faced with certain technical limitations when presenting computer-mediated information. They must work not only within the confines of limited screen space, display areas and page size, they must also conform to the problems of resolution, forward and backward paging, and limited cues regarding lesson length (Benshoof & Hooper, 1993). Because computer-mediated instructions are less flexible than prints in the presentation of information, it is more difficult to effectively present instructional materials on the computer than it is in print (Rayner, 1992). Appropriate means to deliver the instruction to the learners must be incorporated in future research endeavors. Thus, research is needed regarding variation in text presentation levels on the computer screen. In particular, there is the need for

designing text layouts that will accommodate individual learning differences to facilitate the teaching-learning process. In an attempt to explain the cognitive style of filed dependence status (CSFDS), Cross acquiesced:

> Individuals see and make sense of the world in different ways. They give their attention to different aspects of the environment; tackle problems with different methods; construct relationships in distinctive patterns; process information in different but personally consistent modes; and acquire knowledge based on their knowledge structures. Style has a broad influence on many aspects of personality and behaviors; manifesting itself in perception, memorial tasks, cognition and metamemory, interests, social behaviors, and self-concept (Cross, 1976, pp. 115-116).

Cognitive styles of field dependence status are the information processing habits that represent a learner's typical mode of thinking, perceiving, problem-solving, and remembering (Caliste, 1985; Chinien, 1990; Elliot, 1976; Greco & McClung, 1979; Grieve & Davis, 1971; Messick, 1976; Witkin, 1979; Witkin & Moore, 1974). These styles constitute important traits of individual differences among students and appear to have important implications for instructional design. Wallace and Gregory (1985) indicated that there have been over 3000 research studies conducted on cognitive styles through which a large number of cognitive styles have been identified. kirby (1979) provided a comprehensive summary of nineteen different dichotomous CSFDS constructs: perceptive/receptive analyzers; field-dependent/independent status; analytical/non-analytical conceptualizing; risk taking/caution; systematic/non-systematic intuitive; implicative/reflectiveness; cognitive complexity/simplicity; scanning/focusing; constricted/flexible control; broad/narrow category width (equivalence range); conceptual articulation or

discrimination; tolerance for incongruous or unrealistic experiences; leveling/sharping; and conceptual integration and integrative complexity (Kirby, 1979, pp. 52-53). Messick (1976) identified about 25 cognitive style constructs that included those of Kirby. Of these 25 cognitive styles, this article will focus only on one style, cognitive style of field dependence status.

One of the CSFDS which is of significant importance to educators is the cognitive dependence status of field-dependent (FD) and field/independent (FI) learners. Studies abound in the literature on the pragmatic importance of the cognitive construct of FD and FI as they relate to students' achievement, time on task, design implications, and window presentation strategies (instructional delivery). The primary purpose of this article is to review the literature on research studies conducted in the last five years on the effectiveness of window presentation strategies and the cognitive dependence status of field-dependent/independent (FD/FI) learners in a computer-mediated instruction. Secondary to this purpose is to summarize research findings which investigated the factors and the effects of computer-mediated instruction on the studied populations.

Windows and Window Presentation Strategies

Windows (that is, computer screens) are not recent innovations in the design of the human-computer interface. They have been around since the inception of computer assisted instruction (Galitz, 1994; Stark, 1990). Windows allow the user to interact with multiple sources of information, the ability to use graphical input devices in a text or document, and the flexibility to present the graphical features of the display (Lamberski & Dwyer, 1983). Moreover, the most common function of windows is a platform for displaying programs or applications that may also be used as information organizer (Eysneck, 1993; Rayner, 1992). Different parts of the program

may be presented in separate windows. The function of windows helps the user to spatially organize information; and the spatial arrangement represents the semantic network of ideas (Eysneck, 1993).

Presentation strategies are the window presentation style. They are the spatial relationships between windows and the types of operations that can be performed on them (Galitz, 1994, p. 148). Presentation strategies include overlapping, tiling, and mixed displays (Eysneck, 1993; Galitz, 1994; Livingston, 1991; Rayner, 1992). Tiled windows (derived from the common floor or wall tiled designs) appear in one plane and expand or contract to fill up the display surface. They are perceived as less complex, more preferred by novice, are displayed in limited numbers, permit less user controls, and their configurations may not meet the user's needs than the overlapping windows. Overlapping or cascading (zooming) windows have the more flexibility of being placed on top of one another. They posses a three-dimensional quality, appearing to lie on different planes. They are less preferred by inexperienced users, have more user control features, are more flexible, permit the conservation of screen space, are of different sizes. are operationally more complex, have the tendency to be lost within the displayed surface, and require greater user attention (Galitz, 1994).

Windowing can be used in two different ways: (1) windowing refers to a procedure for graphically partitioning the screen into areas (usually rectangular in shapes), so as to visually separate one task or activity from another; (2) windowing implies that the computer can actually handle more than one task at the same time through multi-windows or multi-tasks (Livingston, 1991; Young, 1996). Windows also provide access to more information than a single screen of the same size. While there are a number of window presentation strategies, this article focuses

only on single (paging) and scrolling window presentation strategies.

Windowing Technique

Windowing is a technique in which only a portion of the displayed screen is used for a particular task Eysneck (1993). It will be categorized into a single (paging) and a scrolling window. A paging window is located at the tilted windowing system as a single window. The basic operation of a scroll-bar in a scrolling window is to move up or down and left and right.

Single or Paging Window.

A single window is defined as a page on the screen with two operations such as "forward paging" and "backward paging." It is called a standard window with a single task (Rayner, 1992)). A single window structure can also be considered as a paging window with backward and forward functions that include a task, an idea, or an application (Eysneck, 1993; Rayner, 1992).

Scrolling Window.

A scrolling window is defined as a window with scroll-bar commands on the right of the screen that has only up and down functions (Rayner, 1992). It includes more than one task, an application, and has a different perspective in a window system (Benshoof & Hooper, 1993). Scrolling is a technique to move data across or through the screen. Scroll-bar arrows usually indicate the direction for the window movement. Because scrolling bars provide top-down (vertical) or left-right (horizontal) processes, they represent the direction of the contents (Rayner, 1992).

Cognitive Styles of Filed Dependence Status

Cognitive styles of field dependence status are conceptualized as stable attitudes,

preferences, or habitual strategies that determine a person's typical modes of perceiving, remembering, thinking and problem- solving (Messick, 1976, p. 26). The visual perception in information processing is based on individual perceptual skills. When learners have similar visuals on the screen, their perceptions for the visuals may be different. These differences among learners are based on their cognitive styles, learner characteristics, or perceptual skills. Field dependence status is the "perceptual differential" where the organization of the prevailing field determines the person's perception. Witkin (1979) defined psychological differentiations for the learners by indicating that the field-dependent and field-independent cognitive styles are contrasting modes of processing information. In essence, learners with a field-independent style are likely to use internal referents as primary guides referents (p.14). That is, filed-dependent and field-independent cognitive styles refer to a general psychological differentiation, in which a person perceives part of a field as discrete from the surrounding field as a whole.

Field Dependence Status

The cognitive style of field dependence status was determined as field-dependent, and field-independent based on the visually-oriented Group Embedded Figure Tests (GEFT [Witkin, 1979; Witkin, Oltman, & Karp, 1971]); and as FD, FI, and field-neutral (FN) based on the mean and standard deviation of the GEFT scores (Dwyer & Moore, 1991, 1992, 1994; Griffin & Franklin, 1996; Lamberski & Moore, 1983). The field-independent learner tends to articulate figures as discrete from their backgrounds and can more easily differentiate objects from the embedding context. The field-dependent learner, on the other hand, tends to experience events within the content of the whole. The field-neutral individual is mid-way between these two extreme learning modes (Eysneck, 1993; Livingston, 1991; Young, 1996).

Review of Related Literature

The present article investigated the relationship between window presentation strategies, students' cognitive style on academic achievement, and the completion time in computer-mediated instructions (CMI). The quality of screen designs, window presentation strategies, and individual skills are important factors in the development and implementation of effective CMI and tutorials (Galitz, 1989, 1994; Livingston, 1991; Rayner, 1992). Organizing the user's skills could be solved by effective instruction (Eysneck, 1993; Livingston, 1991; Young, 1996).

The Educational Resource Information Center (ERIC), the Educational Abstracts, and "PsychLit" were the databases used to build the bibliography. I was able to locate about 20 ERIC journals (EJ) and 13 ERIC documents (ED) from 1989 to 1996. Of the 43 ERIC journals and documents, only 12 were directly related to the purpose of this article. The bibliography of secured papers and reports served as other sources of reference. Research shows that field-dependent individuals are more people oriented, tend to be alert to social cues, and generally tend to have more developed interpersonal skills. They prefer group dynamics and demonstrate a preference for academic subject (e.g., psychology, sociology, counseling, etc) that are less analytical; and occupations geared toward helping people. The field-dependent person also appear to be more influenced by others, exhibit more non-verbal behaviors, and are extremely sensitive to social order and criticism. In addition, the field-dependent student are more likely to be developmental students, need more time to solve a particular task, use external referents for self-definition, need more motivation, are more dependent on others, are likely to solve a problem by example, and prefer a spectator approach to concept attainment (Witkin & Goodenough, 1981;

Witkin & Moore, 1974; Witkin, Moore, Goodenough, & Cox, 1977).

The field-independent individuals prefer algorithmic approaches to group dynamics and demonstrate a preference for academic subjects (e.g., mathematics, hard-sciences, engineering, etc) that require theoretical proofs; and occupations with less human interactions (Wallace & Gregory, 1979). They are abstract-analytical, less prone to environmental influences, are more impersonal and less alert to social order, cues, and criticisms, and are more likely to engage in a hypothesis-testing to concept attainment (Caliste, 1985, p. 26). In addition, the field-independent learners are more likely to be non-developmental students, are more likely to need less time to solve a particular task, use internal referents for self-definition, need less motivational themes, are more independent on others, are likely to solve a problem intuitively, and prefer the mediator approach to concept attainment (Witkin & Goodenough, 1981; Witkin & Moore, 1974; Witkin, Moore, Goodenough, & Cox, 1977).

There are some research indications regarding the differential effects on types of reinforcement on field-dependent and field-independent students. Immediate negative reinforcements have more global effects on FD than on FI learners, and results in better learning and more knowledge gains and transfer (Chinien, 1990; Witkin & Moore, 1974). While the FD and FI students are the two extremes on the cognitive style spectrum, the field-neutral individual is more adaptable to any situation. They prefer somewhat less structured instructional sequencing and demonstrate a preference for academic subject (e.g., economics, accounting, soft-sciences, biology, etc) that are less analytical; and occupations (medicine, pharmacology, education, etc.) geared toward helping people in a less structured environment. They prefer moderation in their daily activities with less routines and protocols (Billingsley, 1988; Bork, 1984; Dwyer & Moore,

1991, 992/94; Griffin & Franklin, 1996; Hathaway, 1984; Lee, 1994; Spiro & Tirre, 1980).

Possible Research Questions:

It is important to know how learners with different cognitive style of field dependence status could be affected from different window presentation strategies on the computer screen. It is equally important to know how different window presentation strategies could be used in effective instructional strategies for any computer-mediated instruction (CMI) or tutorial.

This article focuses on the following tentative research proposals as a guide in organizing the reviewed literatures: (1) The effectiveness of window presentation strategies on students' academic achievement in CMI and tutorials. (2) The effectiveness of a CMI completion time of lessons outcomes and performance on outcome measures such as the course criterion tests and/or the CBI tutorial. (3) The academic performances of students classified as field-dependent/independent and/or field-neutral. Consistent with these tentative research proposals are the tentative research questions: **(1)** Is there a significant main effect between window presentation strategies on academic achievement with respect to field dependence status in a CMI and tutorial? **(2)** Is there a significant main effect between window presentation strategies on the completion time of a CMI and tutorial with respect to field dependence status? **(3)** Is there a significant main effect between window presentation strategies on the course criterion tests? (4) Are there any significant interactions between cognitive styles of field dependence status and window presentation strategies? The literatures reviewed in regards to presentation strategies, cognitive styles, and students' academic achievements (performance) could be summarized as follows: (1) presentation strategy and academic achievement; (2) presentation strategies and time on task; (3) cognitive style and performance; (4) cognitive style and time on task; and (5)

implications for educational (instructional) technologists.

Presentation Strategy and Academic Achievement

Eysneck (1993), Livingston (1991), and Rayner (1992) indicated that windowing techniques encouraged learners to focus on the content; that each window provides a different perspective, application, and function; and that learners with different cognitive styles view information differently. They further indicated that presentation options may include a variety of visual options such as graphic displays, typed texts, and videos.

Benshoof and Hooper (1993) investigated the effects of single- and multi-window presentation strategies on academic achievement for different ability [ ] students. These students were classified as high or low ability according to their task performance. They found that there were no differences in the type of windows used; that the high ability students in the single window group demonstrated higher post-test means scores on verbal information and rule use items than other students; that there were significant differences between the high-ability single-window group and all other groups; and that there were significant differences between the high-ability multi-window group and low-ability single-window group. In this study, strategies in short-term memory (STM) and long-term memory (LTM) were found ineffective for multiple window presentations. These results may be able to provide cues for software designers.

In investigating the effect of window presentation strategies (pop-up) in hypertext on readers' memory, Stark (1990) found that pop-up windows could make their contents more memorable for readers, but not in the plain presentation. In conclusion, pop-up information was deemed more memorable when other types of semantic and rhetorical links were implied by the use of a pop-up.

Presentation Strategy and Time on Task

Scrolling is not appropriate for novice users because the inexperienced user may not know how to manipulate -- reducing screens, moving screens, opening and closing screens -- the window environment (Rayner, 1992). Paging (a single window) was preferred by novice users and it resulted in better performance on the sorting task (Livingston, 1991). Results showed that in windowing, novice users in a single window environment performed their tasks faster than in a scrolling environment; and that unpracticed users performed three different tasks (word reading, sorting tasks, and line searching) with both paging and scrolling window techniques (Eysneck, 1993; Livingston, 1991; Rayner, 1992; Tombaugh, et al., 1987).

Supplemental to window presentation strategy, Young (1996) and Rayner (1992) indicated that window location plays an important part in the teaching-learning process. An information placed on windows facilitates transfer of learning when compared to information placed in random locations. Moreover, spatial location becomes an organizer that aides learning by providing encoding links or anchors to existing information.

Cognitive Styles and Academic Achievement/Performance

Field-dependent/independent is an educational psychology construct related to a "global versus analytical way of perceiving. It entails the ability to perceive items without being influenced by the background" (Kirby, 1979, p. 52). This global perception of individual has gained popularity among researchers. Notable figure in the field of cognitive styles of field dependence status was Herman Witkin. Witkin's early approaches to on cognitive styles were based upon World War II fighter pilots. The conjecture under investigation was the impacts of thick clouds or fogs upon pilots' orientation and the subsequent attentiveness of the pilots to maintain "their"

equilibria (body homeostases) in situations that mimicked the actual flight operations. Those pilots who were able to locate their body position to the true vertical position of their environment were labeled field-independent; those who were unable to perform this task were perceived as field-dependent pilots (Witkin & Goodenough, 1981; Witkin, Moore, et al., 1977). Other research efforts amplified Witkin's earlier studies and considerations. Color enhancement was introduced into the literature following the World War II simulation studies.

Dwyer and Moore (1991, 1994) and Lamberski and Dwyer (1983) contended that color coding is directly related to academic achievement. Young (1996), on he other hand believed that instructional designers should incorporate more learner-controlled features in their CMI and tutorial environments. Young indicated that students classified as low and high ability performed differently in self-regulated learning strategies (SRLS) if they have autonomy of the learning environment. His hypothesis predicted a significant main effect for SRLS and that learner-control was more protective than program-control in CMI and tutorial learning environments.

Young's (1996) study was to ascertain whether the type of instructional control and learner level of self-regulated learning strategies (SRLS, high and low) interact to predict different learning outcomes. He tested 26 (13 males and 13 females) seventh graders. These participants were subjected to two treatment groups, SRLS with learner controlled (LC) and SRLS with program-controlled (PC). In a 2 X 2 factorial design, the LC/High SRLS group spent less time on the CBI lessons than the PC/High SRLS group. Furthermore, the PC/High SRLS group outperformed the LC/Low SRLS group; and the PC/High SRLS learners scored significantly higher than the PC/Low SRLS learners in the post-test.

Livingston (1991) and Rayner (1992) showed that learners with different cognitive styles

viewed information differently. Significant differences in performance were found between FD and FI learners on the drawing test (Dwyer & Moore, 1991, 1992/94). Field-dependent individuals, when presented with a visualized presentation, tend to modify the structure but accept and interact with it as presented (Lamberski & Dwyer, 1983). Field-independent individuals tend to act upon a visual stimulus, analyzing it with their own structures (Dwyer & Moore, 1991, 1992/94; Lamberski & Dwyer, 1983). In the Dwyer and Moore (1991, 1992/94), and Lamberski and Dwyer (1983) studies, students were classified into three cognitive learning styles as either field-dependent, field-neutral, or field-independent as a result of their performance on the cognitively oriented GEFT. They indicated that CSFDS is an important instructional variable and that for some type of learning objectives, the processing of color coding instructional materials may reduce achievement differences attributed to differences in cognitive style. The field-independent students scored significantly higher on the drawing test than the field-dependent students on both the black and white, and on the color-coded treatments. Students who received the color illustrations achieved significantly higher scores than those students who received the black and white illustrations (Dwyer & Moore, 1994; Lamberski & Dwyer, 1983). Based on the performance of those students who received only the black and white treatments, the field-independent students achieved significantly higher scores than the field-dependent students on both terminology and comprehension tests (Dwyer & Moore, 1991, 1992, 1994).

With regards to cognition, retention, and achievement, Spiro and Tirre (1980) indicated that knowledge-based processing is more "stimulus bound" when learners are more "text bound" in analogous tasks; and that schema utilization is positively correlated with high rate of recall. The hypothesis tested in this study was that one source of style difference in skilled discourse

processing would be related to biases in the extent to which one uses knowledge schemata (Spiro & Tirre, 1980, p. 204). They found that greater reliance on schemata-based processes was evinced by those who, in other situations, demonstrated abilities analogous to those required by applying schemata to text. They concluded that the treatment (restaurant) group had greater mean rate of recall and retention and schemata reliance than the control (grocery) group. Furthermore, their study was favorable to the high GEFT students. Students classified as high cognitive learners have higher learning abilities than those classified as low cognitive learners (Spiro & Tirre, 1980).

Cognitive Style and Time on Task

Field dependence is marked by a propensity for making intuitive responses that are affected by contextual factors without determining the relevance of these factors (Messick, 1976). Dwyer and Moore (1991), Griffin and Franklin (1996), and Lamberski and Dwyer (1983) classified students into field-dependent, field-neutral, and field-independent based on their scores on the GEFT. In their studies, students who achieved one half standard deviation below the mean were classified as field-dependent and those in the middle were classified as field-neutral. Those students with mean GEFT above one-half standard deviation were classified as filed-independent.

In investigating the completion time in an instructional gaming environment, Livingston (1991) observed that the time required to complete each block of games was inversely related to time on task. This inverse relation was attributed to practice. In addition, she found that performance on a computer task varied according to the complexity of the color presentation used. That is, the greater the number of multiple color exposures, the lesser the retention and recall abilities of the students. Livingston's (1991) conclusion was not supported by Dwyer et. al. (1983, 1991, 1992) studies. The Dwyer related studies were not computer related. A contrasting

effect was also discovered in Young's (1996) study.

Young's (1996) study determined whether the type of instructional control and learner level of self-regulated learning strategies (SRLS, high and low) interacted to predict different learning outcomes. He tested 26 (13 males and 13 females) seventh graders. These pupils were subjected to two treatment groups, SRLS with learner controlled (LC) and SRLS with program-controlled (PC). In a 2 X 2 factorial design, the LC/High SRLS group spent less time on the CBI lessons than the PC/High SRLS group. Furthermore, the time on task for the interaction effect between the PC/Low and High SRLS group and the LC/Low and High SRLS groups was not significant.

Implications for Instructional Design Considerations

Research has linked the cognitive style of field dependence status to instructional design developments and implementation. Researches conducted in educational spheres suggested that cognitive style of field dependence status has greater potential for educators and educational problems; and that there are some research indications that this approach may have some pragmatic implications to a variety of educational dilemmas (Tombaugh, et al., 1987).

In a study conducted to investigate the effects of CSFDS on instructional design, Grieve and Davis (1971) provided their participants (global [FD] and analytical [FI] learners) with two sets of instructional delivery methods that would either inductively or deductively aid the learners in comprehending their instructional materials. A significant interaction was found between CSFDS and instructional delivery method. The deductive methodology was more effective with FI learners.

Greco and McClung (1979) investigated the effect of attention-directing learning

technique for students classified as global (FD) and analytical (FI) learners. The hypothesis considered in this study was that attention-directing would be protective for the FD than for the FI learners. The treatment for this study was audio manipulation -- "supplementary sound" and "attention-directing" audio narrations -- that were administered to global and analytical sixth graders. Two identical versions of a slide-tape lesson were with these treatments. Results of the study indicated that the FI learners better than the FD learners regardless of the treatment used. This contradicted their original hypothesis. Thus, the attention-directing technique was found more protective for the analytical than the global learners.

Sheriff and Williams (1980) conducted a meta-analysis to determine the implications of the cognitive styles of field dependence status on instructional development and design. The results of their analysis indicated that the CSFDS-learning match could result in significantly greater learning concept

Conclusions and Recommendations:

Computers have different applications in education. They can be used to assist daily school administration, to provide training environments, or to deliver instructions. In using computers to deliver programs to students, the support of full color and full motion and screen video display playback on the computers are desirable as video images are realistic and lifelike (Galitz, 1994). The same is true when using computers to deliver instructions (Lamberski & Dwyer, 1983). It has been shown that color coding improves students' information retention and knowledge transfer, increases students' attention span, and enhances students' cognition than non-color coding in CMI and tutorials (Dwyer & Moore, 1991; Lamberski & Dwyer, 1983; Young,

1996).

Messick (1976), Lamberski and Dwyer (1983), Dwyer and Moore (1991), Livingston (1991), and Galitz (1994) indicated that the field-dependent learner views information on the computer screen globally and differently than the field-neutral and the field-independent learners. Each learner has different "perceptual differential skills," attention span, organization skills and reading abilities to articulate information from computer windows.

Presentation Strategy, Cognitive styles, and Achievement

Learning styles are those unique ways whereby an individual gathers and processes information. They are the ways by which an individual prefers to learn. Learning styles tend to be stable traits (Messick, 1976); and may affect a wide range of learning behaviors (Eysneck, 1993).

Some researchers have questioned whether aptitudes such as cognitive style of field dependence status exists as stable traits (Dwyer & Moore, 1991; Lamberski & Dwyer, 1983; Livingston, 1991; Young, 1996); whether it could be used in conjunction with ACT/SAT scores to predict college performance (Griffin & Franklin, 1996); and whether they are different from general intelligence (Messick, 1976; Spiro & Tirre, 1980; Witkin, 1979). More specifically, they have argued that cognitive style measures such as GEFT are best interpreted as ability tests (Griffin & Franklin, 1996; Messick, 1976). When considered an ability, field dependence loses its bi-polar, value-neutral aspects (Livingston, 1991).

Interpretation of field dependence as an ability would suggest that instructional procedures for CAI, CBI, or hypermedia database should focus on assisting field-dependent learners to improve their performance on analytic tasks. This instruction might focus on development of search strategies similar to library index cards. On the other hand, interpretation of field

dependence as a style would suggest an emphasis towards accommodating individual learning differences. This focus allows for a broader view of the implications of CMI and tutorials, a view that extends beyond the classroom.

Presentation Strategy, Cognitive style, and Time on Task

The results of the reviewed literatures indicated that field dependence and window presentation strategies should be considered in text reading, CMI development, instruction, and software design. Students with different cognitive styles need to be involved successfully with effective color coded texts, CBI environments, and perceptual movements to achieve high scores in their classrooms. These results indicated that window type in computer screen design, field dependence levels, and reading abilities are important considerations.

The current growth in the use of mediated instructions, both in education and communications, suggests that CMI and presentation strategies deserve the attention of educational (instructional) technologists. Continued research on how different learners use windows in CMI and tutorial environments will help educators and instructional technologists shape the future of literacy in America. Research has shown that the type of window presentation style (tiled or overlapping) should be used in varying contexts. Tiled windows should be used for single task activities, tasks that require little window manipulation, and inexperienced users. Overlapping or cascading windows should be used for switching between tasks, experts, nonpredictable display contents, and tasks the necessitate a greater window manipulation (Eysneck, 1993; Galitz, 1994).

Further investigations should examine how learning styles may be "good" predictors for successful performance in a computer course, particularly, with regards to specific learning tasks.

In addition, a comparison of the effect of students' knowledge or lack of knowledge of their learning style on performance should be conducted. Another investigation of a combination of learner characteristics, such as gender and ability, may yield additional information about how students learn and process information. Finally, how learning styles and other learner characteristics influence performance on other course content might be investigated as well.

Cognitive styles and Instructional Design

Knowledge acquisition and transfer have both developmental and curricula implications for both globally and analytically oriented individuals. The cognitive styles of field dependence status which constitute an important aspect of indidualization among students with regards to the way they acquire, process, and interpret information, seems to have potential impacts on students' cognitive and metacognitive abilities and awareness (Billingsley, 1988; Bork, 1984; Card, Pavell, & Farrell, 1984; Chinien, 1990). Despite the growing interest in educational arenas to address individual differences in conveyors of instructional materials, little has been done to incorporate cognitive factors into the curricula and instructional design (Gould & Grischkowski, 1989, 1994; Griffin & Franklin, 1996; Hathaway, 1988; Lee, 1994; Pitts & Thompson, 1984; Rambally & Rambally, 1987; Vieth, 1988).

Gagne (1982) and Keef (1982) stressed the importance of incorporating cognitive and affective variables into the curricula and instructions. Gagne emphasized the integration of internal (cognitive) and external (affective) domain components into the instruction. Keef pointed that the key to effective instruction lies in understanding the scope of students' learning styles; and to develop and design instructions and materials that would respond to individual learner's needs. These emphases are "in-situ" curricula-driven and instruction-based.

The problem is in both content- and context-dependent instructional delivery techniques. Instructions that are discordant and concordant to students' learning styles can be facilitating or debilitating depending upon the students' information processing capabilities and background (Elliot, 1976; Eysneck, 1993; Griffin & Franklin, 1996; Hannafin & Hooper, 1989; Kirby, 1979; Kruk, 1984; Rayner, 1992; Schwarz, Beldie, & Pastoor, 1983; Spiro & Tirre, 1980; Tombaugh, et al., 1987). Solutions to these problems have been offered (e.g., Elliot, 1976; Galitz, 1989/94; Gagne, 1992; Messick, 1976).

Experimental approaches that accommodate cognitive domains have focused on multiple treatments (Dwyer, et al., 1991, 1992/94; Livingston, 1996; Gagne, 1982). Matching instruction to individual learner differences has proven to be a very difficult task. No matter how the instructional mixture is attained, one learner is always differentially treated better (or worse) than the other. Research has shown that the assessment of the task performance is a fruitless process (Gagne, 1982; Caliste, 1985; Chinien, 1990; Eysneck, 1993; Gagne, 1992; Rayner, 1992). A consequence of this is the "regression to the mean." This match or mismatch is a problem that has never been resolved. An ideal situation would be to develop and design instructional units or modules that are cost effective and are free of bias to all learners (Tombaugh, et al., 1987).

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