DOCUMENT RESUME

ED 323 941 IR 014 564

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TITLE Affective and Cognitive Influences of Textual Display in Printed Instruction.

PUB DATE Feb 90

NOTE 15p.; In: Proceedings of Selected Paper Presentations at the Convention of the Association for Educational Communications and Technology; see IR 014 535.

PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Academic Achievement; Analysis of Variance; Chi Square; Higher Education; Intermode Differences; *Layout (Publications); Preservice Teacher Education; Student Teachers; *Text Structure

IDENTIFIERS Instructional Materials Motivation Scale; Printed Materials; *Text Design

ABSTRACT

This study examined the influence of textual display in printed instruction on the attention, performance, and preference of 90 preservice teachers, and investigated differential effects of textual display for high and low ability learners. Textual display was operationally defined as the arrangement of specified elements on the printed page, and was manipulated by varying text and column width and position, horizontal and vertical spacing, and heading placement in three versions--Simple Textual Display, Moderate Textual Display, and Complex Textual Display--of a printed self-instructional text. Ability was measured by grade point average. Attention was measured by the Attention subscale of the Instructional Materials Motivation Scale (IMMS). Performance was measured by an objective-referenced test of recall. Preference was measured by items from the IMMS Attention and Confidence subscales. Data were analyzed using analysis of variance and chi-square. Results indicated that there was an interaction between ability and textual display for performance, but not for attention. Results also indicated that textual display significantly influenced performance, but not attention. The moderate textual display produced significantly higher performance scores for low ability subjects. Results of the test for preference revealed that, of the three versions, learners preferred the text exhibiting the Moderate Textual Display. (62 references) (Author/GL)

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Abstract

This study examined the influence of textual display in printed instruction on the attention, performance, and preference of 90 preservice teachers, and investigated differential effects of textual display for high and low ability learners.

Textual display was manipulated through three versions of printed instruction. Ability was measured by GPA. Attention was measured by the Attention subscale of the Instructional Materials Motivation Scale (Keller, 1987). Performance was measured by an objective-referenced test of recall. Preference was measured by items from the IMMS Attention and Confidence subscales.

Data were analyzed using analysis of variance and chi-square. Results indicated that there was an interaction between ability and textual display for performance ($p=.009$), but not for attention. Results also indicated that textual display significantly influenced performance ($p=.004$), but not attention. The Moderate Textual Display produced significantly higher performance scores for low ability subjects ($p<.001$). Results of the test for preference revealed that, of the three versions, learners preferred the text exhibiting the Moderate Textual Display.

Affective and Cognitive Influences of Textual Display in Printed Instruction

Introduction

Nationwide surveys show that over 50% of learning activities are based on the use of textbooks and related print materials, and that in some areas, teachers rely almost exclusively printed stimuli (Bullough, 1988; Knirk & Gustafson, 1986; Nelson, Prosser, & Tucker, 1987). Researchers report that learners tend to resist print more than they would resist a lesson from some other instructional medium (Knirk & Gustafson, 1986). Learners perceive print instruction to require more mental effort than other delivery systems, and this perception influences their willingness to learn from textual stimuli (Salomon, 1983). Since learner interest (or lack of interest) in the instruction can influence performance (Keller, 1983), designers must consider the motivational or affective aspects of learning from text when developing print instruction (Hartley, 1987, Sless, 1984; Stewart, 1989).

Keller's (1983) theory of motivation illustrates the interrelationships of motivation, performance, and instructional influence by describing the effects that learner characteristics and environmental factors have on motivation and performance. Keller (1986) identified four categories of learner and/or environmental variables wnich affect motivation to learn: attention, relevance, confidence, and satisfaction. Analysis of the learner's motivational status, in regards to these four requirements, determines personal input deficiencies which might be alleviated by environmental inputs, such as instructional stimuli, to promote successful performance.

With printed instructional stimuli, a personal input deficiency in Attention may result from the instruction's appearance. This deficiency might be alleviated by a textual display (overall visual appearance of printed materials) that arouses and maintains the learner's interest. This interest could lead to increased motivation tc learn from the textual instruction, which might positively influence performance.

The primary purpose of this study was to examine the influence of textual display in printed instruction on learner attention to the instruction and performance of the instructional goal. Secondary purposes were to investigate any differential effects of textual display for high and low ability learners and to determine learner preference for textual display.

Background

Textual display has been defined as "the manner in which text information is presented on a page or in a chapter" (Duchastel, 1982, p. 167). Grabinger's (1985) study of textual display on electronic screens revealed that three main dimensions affected student ratings of textual display: organization, structure, and spaciousness. The importance of easily-perceived organization and structure to learning from printed stimuli has been established (Brandt, 1978; Brooks & Dansereau, 1983; Gerrell & Mason, 1983; Glynn & Britton, 1984; O'Shea & Sindelar, 1983; Reder & Anderson, 1982; Rumelhart, 1980; Shimmerlik, 1978).

Spaciousness has also been found to influence learning from textual instruction. The level of crowdedness or spaciousness can be referred to as the density of the textual display, which is differentiated from the density of the textual information. Information density is the amount of elaboration provided in the printed instruction (Fisher, Coyle, & Steinmetz, 1977; Reder, Charney, & Morgan, 1986). Though the two types of density were not differentiated in their study, Morrison, Ross, and O'Dell (1988) compared high and low density displays. Results revealed no significant differences in achievement, though high density displays were preferred. This contradicts Grabinger's (1985) results which found that students prefer text designs with lots of white space and openness. Additional research could help clarify these differences.

Two dependent variables that might be examined in relation to textual display are attention and performance. Attention, perception, and learning are intertwined - practically and theoretically (Fleming, 1987). Motivation, including the arousal and maintenance of attention, are affected by novel, challenging, moderately complex stimuli (Berlyne, 1966; Deci, 1975; Gagne, 1985; Kagan, 1972;). Stewart (1988) states that arousing of interest and focusing of attention can be induced by an affective aspect of text; and Turnbull and Baird (1975) state that typographic techniques can be employed to make an instuctional text more interesting and challenging. Because features of text design, such as graphic cues, heading placement, and layout (Bovy, 1981; Brooks, Dansereau, Spurlin, & Holley, 1983; Coles & Foster, Fleming & Levie, 1978; Grabinger, 1985; Hartley, 1986; Wager, 1987; Thiagarajan, 1977;) can make printed materials novel, challenging, or moderately complex, textual display can have an affect on learner attention.

Jonassen (1982) proposes that cognitive processing can be "text induced." Design aspects of the text presentation can help the learner semantically encode the

stimulus and conceive linkages between features of the stimulus that will later serve as cues for retrieval (Wager, 1987), so the textual display can be manipulated to facilitate comprehension (Duffy & Waller, 1985; Stewart, 1988). Textual organization and structure, which are logical and visually explicit, have been found to have an effect on learning (Brandt, 1978; Cocklin, Ward, Chen, & Juola, 1984; Glynn & Britton, 1984; Meyer, 1981, 1985; Singer, 1985; Winn, 1981; Witkin, Moore, Goodenough, and Cox, 1977). The structure and organization of printed instruction can be made explicit in text (Stewart, 1989b) through verbal and typographic cueing systems (Beck, 1984; Felker, 1980; Glynn, Britton, & Tillman, 1985; Grabinger & Albers, 1988; Loman & Mayer, 1983; Lorch & Chen, 1986). Textual display that shows explicit structure and organization can promote performance.

One individual difference that may have a moderating effect on attention and performance is student ability. Learner responses to textual display could be based on different capacities for processing information (Jonassen, 1982). Studies have shown that high and low ability students benefit differentially from typographical cues and from meaningfully segmented text (Beck, 1984; Gerrell & Mason, 1983; O'Shea & Sindelar, 1983; Wilson, Pfister, & Fleury, 1981). An uncomplicated textual display that explicitly exhibits the organization of the instruction may be more influential with lower ability students. The ability of high performance students to organize as they read and to use the cues provided may override any differences for textual display.

Method

Independent variables were textual display and ability. Textual display refers to the manner in which text information is presented on a page and was operationally defined as the arrangement of specified elements on the printed page (Turnbull and Baird, 1975). This variable was manipulated by varying text column width and position, horizontal and vertical spacing, and heading placement in three versions (Simple Textual Display, Moderate Textual Display, Complex Textual Display) of a printed self-instructional text (see Table 1). Entitled The Student Teaching Handbook, this text presented information on the expected outcomes and criteria for evaluation of the student teaching experience. Ability was defined as the subject's measured achievement and motivation to succeed in educational activities (Adams, Waldrop, Justen, & McCrosky, 1987) and was measured by cumulative grade point average. High and low ability subjects were identified as those, in each of the three groups, having the

fifteen top and bottom GPAs, respectively.

Attention, performance, and preference were the dependent variables. Attention was defined as the arousal and maintenance of interest in instruction and was measured by the Attention subscale of the Instructional Materials Motivation Scale (Keller, 1987). The IMMS is a 36 item, Likert-type instrument which was developed to measure the presence or absence of the motivational components of attention, relevance, confidence, and satisfaction in instructional materials. The internal consistency for the instrument is .89 and the reliability of the Attention Subscale (12 items) is .88 (Keller, Subhiyah, & Price, 1989).

Performance was defined as achievement of the instructional goal and was measured by a 14 item multiple-choice, objective-referenced test of recall. Preference, which refers to learner perception of textual display across various descriptors, was operationally defined as learner selection of one of the three versions. This variable was measured by 18 items from the IMMS Attention and Confidence subscales.

The data were analyzed by analysis of variance and chi-square, using an alpha level of .05 for all tests. For the attention and performance variables, an interactive model was followed. Chi-square was used to test the preference variable.

Subjects were 90 students enrolled in the final field experience of their undergraduate teacher education program at a small public college in South Georgia. Student teachers were randomly assigned to one of three treatment conditions and the treatments and testing were administered during the Student Teaching Orientation. Each group received instruction from one of the three texts and were then given the Attention and Performance tests. Upon completion, copies of all three versions were distributed and used as a basis for response to the Preference measure. (A total of 128 student teachers were assigned and tested; but due to the high and low ability identification, data for only 90 - 30 in each treatment condition - were analyzed.)

Results

Results indicated that there was an interaction between ability and textual display for performance ($p=.009$), but not for attention (see Tables 2, 3, & 4). Results also indicated that textual display significantly influenced performance ($p=.004$), but not attention (see Tables 3 & 4). The Moderate Textual Display produced significantly higher performance scores

for low ability subjects ($p<.001$). Results of the test for preference revealed that, of the three versions, learners preferred the text exhibiting the Moderate Textual Display (see Tables 6 & 7).

Discussion

Results did not suport the expectation that textual display would significantly influence attention. These findings may be explained by the situation and the subjects' entry level of motivation. It is likely that the anticipation of the student teaching experience induced such a high motivational state that subjects may have needed no alleviation of attention deficiencies by the instructional stimuli.

Analysis showed that textual display had a differential effect on the performance of high and low ability learners. These results show that a moderate textual display can improve performance of low ability learners.

The results of the preference test show that subjects had a clear prference for the Moderate Textual Display. This could mean that, eventhough they may have been intrinsically motivated to attend and perform, the students still had strong feelings about the instructional materials they would prefer to receive. This finding suggests thqt there are affective aspects of textual display in printed instruction and that text organization and structure and text density contribute to these affective dimensions.

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Table 1
Variations in Textual Display

Element	Textual Display		
	Simple	Moderate	Complex
Text column			
width	medium	medium	wide
position	central	side	central
Spacing			
vertical			
interlinear	double	single	single
paragraphs	indented	spaced	indented
horizontal			
right	unjustified	unjustified	justified
Headings	intact	marginal	embedded

Table 2
Means (and Standard Deviations) for Attention and Performance of High and Low Ability Preservice Teachers

	Textual Display			
	Simple	Moderate	Complex	Total
Attention				
High Ability	35	36	37	36
	(7.5)	(6.7)	(4.3)	(6.2)
Low Ability	36	38	36	37
	(6.0)	(6.6)	(8.4)	(6.9)
Performance				
High Ability	88	84	87	86
	(.05)	(.08)	(.07)	(.07)
Low Ability	77	86	79	80
	(.11)	(.06)	(.10)	(.10)

Table 3
ANOVA Summary for Performance

Source	SS	df	MS	F	p
Explained	.15	5			
Textual Display	.01	2	.005	.81	.45
Ability	.07	1	.08	12.43	.001
Interaction	.06	2	.03	5.04	.009
Residual	.53	83	.006		
Total	.68	88			

Table 4
Simple Main Effects Analysis of Performance

Source	df	MS	F	p
Textual Display				
Simple	28	.67	4.49	.001
Moderate	29	.72	1.97	.441
Complex	28	.69	1.82	.019

Table 5
ANOVA Summary for Attention

Source	SS	df	MS	F	p
Explained	63.3	5			
Textual Display	15.5	2	7.7	.18	.84
Ability	6.8	1	6.8	.15	.69
Interaction	41.2	2	20.6	.47	.63
Residual	3667.9	83	44.2		
Total	3731.2	88			

Table 6
Percentage of Learner Selection of Textual Display and Chi-Square Results

Items	Textual Display			Chi	p
	Simple	Moderate	Complex		
Positive					
1	41.4	52.3	6.3	30.03	.0000
2	25.2	70.9	3.9	73.32	.0000
4	32	62.5	5.5	44.79	.0000
5	29.7	64.1	6.3	51.45	.0000
7	25.8	69.5	4.7	56.18	.0000
8	38.3	55.5	6.3	42.82	.0000
11	28.3	66.1	5.5	38.59	.0000
12	26.8	67.7	5.5	52.01	.0000
13	31.7	35.7	32.5	.8262	.9349
14	31	63.5	5.6	49.41	.0000
17	27.8	67.5	4.8	52.76	.0000
18	27.8	66.7	5.6	63.56	.0000
Negative					
3	18.8	4.7	76.6	9.86	.0428
6	18	9.4	72.7	9.03	.0444
9	20.3	3.1	76.6	10.31	.0356
10	22.8	5.5	71.7	24.22	.0001
15	20.3	3.1	76.6	10.31	.0356
16	13.3	4.7	82	10.87	.0376

Table 7
Summary of Distribution of Items Measuring Learner Preference of Textual Display

Items	Textual Display		
	Simple	Moderate	Complex
Positive			
First	0	11	0
Second	11	0	0
Third	0	0	11
Negative			
First	0	0	6
Second	6	0	0
Third	0	6	0