

Learner and Task Considerations in Designing Instruction for Native Adult Learners

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The study contributes to an exploration of directions in which instruction might be individualized, taking into account modality strength and preference in learning. Rather than following the suggestion in the literature that Native people are predominantly "visual" in learning style in comparison with non-Natives, in this study, which involved 111 non-Native adult learners and 18 Native adult learners, all participants were assessed for relative preference for visual and verbal learning style. Knowledge and comprehension test scores were compared for the groups, relative to their use of instructional material that was differentiated by the inclusion or absence of analogical visual illustration. Comparisons between performance outcome measures on the one hand and mental imagery and verbal reasoning subtest scores on the other seemed to indicate different general patterns between Natives and non-Natives. A formally untested but evident conclusion, however, is that individual differences were as important as Native/non-Native differences. The evident complex interaction of learning style modality preference, instructional material, learning task, and individual and cultural background suggests that in the creation of learning materials, the interaction of instructional variables, not the variables in isolation, should be the focus.

Introduction

The past decade in educational research has seen an increase in attention to assessing the effectiveness of "individualized" instruction. "Individualized," as opposed to "group-based," instruction arose with Bloom's (1984) concept of mastery learning, which considered all learners as equally capable, given sufficient time in which to learn. Recently, learning style has been one of the specific learner characteristics identified as important in designing individualized instruction.

The concept of "learning style" as a significant instructional variable first emerged with the rise of cognitive psychology in the 1970s (Messick, 1976). Since then, three distinct dimensions of learning style have been identified: (a) cognitive, or information processing habits, (b) affective, or personality-related modes of response, and (c) physiological, or biologically based modes of response (Keefe, 1987). Perceptual modality preferences (or preferred reliance on one of the sensory modes for processing information), is a cognitive dimension that has received only sporadic attention over the past few decades.

Researchers who have investigated visual perceptual modality preferences have suggested that up to 30% of the North American adult population have a strong preference to use this modality to process new information (Paivio, 1986; Richardson, 1977). In contrast, 30% of this population appear to have a strong preference to use their verbal modality, while the remaining 40% do not show a strong preference one way or the other. It is important to note that these researchers have also discovered that having a strong preference for one modality

does not necessarily imply a lack of preference for the other; being a "verbalizer" is not simply the reciprocal of being a "visualizer" (Hiscock, 1978).

From an instructional point of view, the critical issue regarding visual-verbal preferences is learners' ability to benefit from the visual-verbal nature of the information provided in the learning materials available. Unfortunately, learning materials in both educational and business settings are frequently presented in a verbal manner only, thereby putting a large portion of North American adults at a marked disadvantage when it comes to acquiring new knowledge. Given the substantial portion of visually oriented adult learners, the instructional implications of utilizing more visually based learning materials could be profound. Fortunately, the recent introduction of visual technologies into the classroom has allowed individual learners' visual abilities (referred to as "visual literacy"; see Sinatra, 1986) to compensate to a certain extent, for weak verbal information processing skills (if present).

Although the debate among researchers about the implications that identifiable learning styles holds for instruction is nonconclusive, the practice among educators of adapting instruction to accommodate different learning styles has become very popular. Unfortunately, this practice is more often guided by simplistic and/or questionable models of instructional design than by careful consideration of the learner populations.

The effect on learning achievement of being from a nondominant cultural background is one instructional variable that has received relatively little attention in the research literature. Studies that have examined Native North Americans have generally concluded that this cultural heritage appears to be related to a predominantly visual perceptual modality preference for processing information (Kaulback, 1984; More, 1987). Although the evidence for this conclusion is questionable (Kleinfeld & Nelson, 1991), teachers have been recommended to employ more "visually oriented" teaching methods with Native learners. Such a narrow (i.e., stereotypical) approach to instructional design can be both misleading (in terms of the strategies used to design instruction for these groups) and ultimately harmful (in terms of the actual learning achieved by these groups). A far better approach would be one that avoids the temptation to stereotype by carefully considering the profile of the specific abilities of the individual learner.

Background to the Problem

Kaulback (1984), in an extensive review of North American research, concluded that Native children have a predisposition to a visual style of learning (possibly as a result of environmental or social factors; see also Arbess, 1981, and Swisher & Deyhle, 1989) that may encumber their ability to learn from verbally oriented materials. The use of visual (i.e., pictorial) materials seems to result in more effective learning by these students. More (1987) has also documented a number of studies of young Native learners that appear to demonstrate Native learners' strengths in using visual, as opposed to verbal, information to learn new concepts.

In their exhaustive review of the research, Cronback and Snow (1977) concluded that well designed graphics can act as prostheses for learners with poor spatial ability. Educational research has confirmed that, in printed instruction, adding pictures to represent verbal information can result in better learning outcomes (Dwyer, 1978, 1987; Fleming & Levie, 1978; Levie & Lentz, 1982).

As a result, educators have been recommended to use more visually oriented teaching methods with learners in general, and with Native learners in particular. Notably absent in the literature on Native learning styles is discussion of other key instructional variables (such as other cognitive abilities and specific cognitive demands of the learning task) that are at least as important as perceptual modality preference.

The purpose of this article is to start to address this need by explaining the unexpected results of a study that looked at the interactive effects of perceptual modality preference (hereafter referred to as learning style) and instructional material format on the learning achievements of Native and non-Native subjects (Wiesenberg, 1990). The study examined the effect that pictures embedded in text-based, self-instructional materials had on the acquisition of knowledge by Native and non-Native adult learners. The findings of the study indicated that analogical pictures (visual representations of verbal analogies) functioned as cognitive aids for learners having a particular set of cognitive abilities. Depending on the level of difficulty of the learning task, cultural background also appeared to be an important learning variable. The overall research results suggested that taking a visual, as opposed to verbal, approach to designing instruction for Native adult learners should be carefully guided by specific learner and task variables. An overall approach to instruction (complementary versus compensatory) is also discussed as it relates to individual learners' ability profiles.

The Study

Wiesenberg (1990) proposed that analogical pictures could serve as a cognitive aid for learners in a text-based, self-instructional context. The specific learner characteristics investigated were subjects' degree of preference for utilizing their visual sensory modality to process information, their spatial perceptual ability, and their verbal reasoning ability. The study examined how subjects' visual learning style (assessed by combining sensory modality preference and spatial perceptual ability test scores) interacted with text-based, self-instructional materials designed to teach the principles of career planning. The specific hypotheses were that: (a) analogical pictures embedded in text-based, self-instructional materials would function as conceptual bridges between existing and new knowledge; and (b) learners with a strong natural preference for visual information processing would benefit more from the embedded pictures than would learners with a weak preference for visual information processing. Native subjects were expected to have a strong natural preference for visual information processing, while non-Native subjects were expected to be evenly dispersed along a strong-to-weak continuum of preference for visual information processing.

One hundred and twenty-nine adult students enrolled in three different Northern Alberta postsecondary institutions were subjects in the two (instructional conditions) by two (strong versus weak visual learning styles) factorial design study. The Native subject group consisted of an intact classroom of 18 Treaty status students.

The instructional conditions consisted of two different versions of a text-based, self-instructional booklet designed to teach a five-step career planning process. The two different versions were text (printed instruction only) and text plus pictures (printed instruction supplemented with pictures). The instructional booklets were created using a systematic method that integrated Gagne's (1989) model of design-

ing textual materials with Goldsmith's (1984) model of designing pictorial materials (Wiesenberg & Baine, 1991).

The subjects' learning styles were assessed by summing their standard scores on an objective measure of imagery (Space Relations subtest of the Differential Aptitude Test) and subjective measure of imagery (Paivio's Individual Differences Questionnaire). This procedure has been employed and validated by other researchers in the field (Richardson, 1977).

Subjects' acquisition of key superordinate and subordinate concepts in the instructional booklets were assessed on two performance tasks differing in level of complexity: (a) knowledge (open-ended questions), and (b) comprehension (multiple-choice questions).

The results of the analysis of covariance (with prior knowledge as the covariate) failed to reveal any significant main effects for instructional condition, or interaction effects for subjects' learning style and instructional condition. However, subjects' learning style did account for a significant amount of the variance. Although all subjects achieved significant gains from pre- to post-testing, low visual subjects made significantly larger gains than did high visual subjects. Overall, trends in the data revealed that Native and non-Native subjects responded differently on the two performance outcome measures. Native subjects' patterns of scores were opposite to those of non-Native subjects on the more difficult test of comprehension multiple-choice (see Figure 1), but the same as that of their non-Native counterparts on the less difficult test of knowledge (open-ended, see Figure 2).

Subjects' learning style also appeared to be a factor in their response patterns. In terms of the more difficult task, low visual Native subjects appeared to benefit from the presence of the analogical pictures in the instructional materials, whereas low visual non-Native subjects appeared unaffected when they were present. High visual Native subjects, on the other hand, appeared to perform at a lower level when the analogical pictures were present, while their non-Native counterparts seemed unaffected when these pictures were present in the instructional materials.

In terms of the less difficult task, the general trend for all subjects was for high visual subjects to be encumbered by the presence of the analogical pictures and low visual subjects to benefit from the presence of these pictures. This pattern of performance was much more pronounced for Native subjects than it was for non-Native subjects.

There were also notable differences in the strength of the relationships (Pearson product-moment correlation coefficients) between Native and non-Native subjects' verbal reasoning scores (as measured by the Verbal Reasoning subtest of the Differential Aptitude Test) and performance outcomes, and mental imagery scores (as measured by the Imagery subtest of the Individual Differences Questionnaire) and how well they did on the two performance outcome measures (see Table 1). Native subjects were influenced less by verbal reasoning in their response to both performance measures and more by a preference to use mental imagery than were their non-Native counterparts. It would appear that Native and non-Native subjects used different sets of abilities when completing these two tasks.

In summary, while all subjects' performance on the outcome measures appeared to be affected by their learning styles, Native subjects' performance appeared to differ from that of non-Native subjects in these ways: (a) in the relationship between learning style and the pattern of responses to the more

Table 1. Summary of Significant Pearson Product-Moment Coefficients for Native (n=18) and Non-Native (n=111) Subjects

Variable		Post	Qu.	VT	SR	Imag.	Verb.	Sex	Grade	Age
Pre	Native	.57	.55	-	-	.57	-	-	-	-
	Non-Native	.61	-	.59	.32	.19	.21	-	.30	-
Post	Native		.45	-	-	-	-	-	-	-
	Non-Native		.39	.48	.32	-	.15	-	.19	.19
Qu.	Native				.40	-	-	-	-	.61
	Non-Native				.16	-	-	-	-	.30
VR	Native								.59	-
	Non-Native				.48	-	.26	.27	.32	-
SR	Native					.43	-	-.50	-	-
	Non-Native					.26	-	-	.34	.24
Imag.	Native									.48
	Non-Native						.29	-	.16	-
Verb.	Native									-
	Non-Native									-
Sex	Native									-
	Non-Native									-
Grade	Native									-
	Non-Native									.23

p<.05

Imag.=I.D.Q. Imagery Scale

Verb.=I.D.Q. Verbal Scale

Qu.=Open-ended Questionnaire

complex task, (b) the strength of learning style-performance interaction in the less complex task, and (c) in the specific cognitive abilities used to perform each task.

Discussion of Results

Two important differences exist between Native subjects described in previously cited research literature and those in the present study; Wiesenbergs' subjects were older (average age 31 years) and from a very select group. The fact that they were enrolled in a pre-university/college program means that they were more academically successful and probably more verbally oriented than their non-college/university-bound peers. Their older age may have allowed them more time to acquire the prerequisite verbal skills that enabled them to benefit from a formal education, a hypothesis supported by the strong Pearson product-moment correlations between their test scores and age (.61), and their verbal reasoning scores and grade level (.60).

Contrary to expectations (but consistent with the above hypothesis), Native subjects generally had lower visual learning styles and lower verbal reasoning scores than did their non-Native counterparts. In this study, verbal and spatial ability were quite strongly correlated (.50), indicating that having a high visual learning style was related to having strong verbal abilities. The lower verbal reasoning and spatial perception scores could have been a function of weaker academic skills, culture bias in the testing instruments, or both.

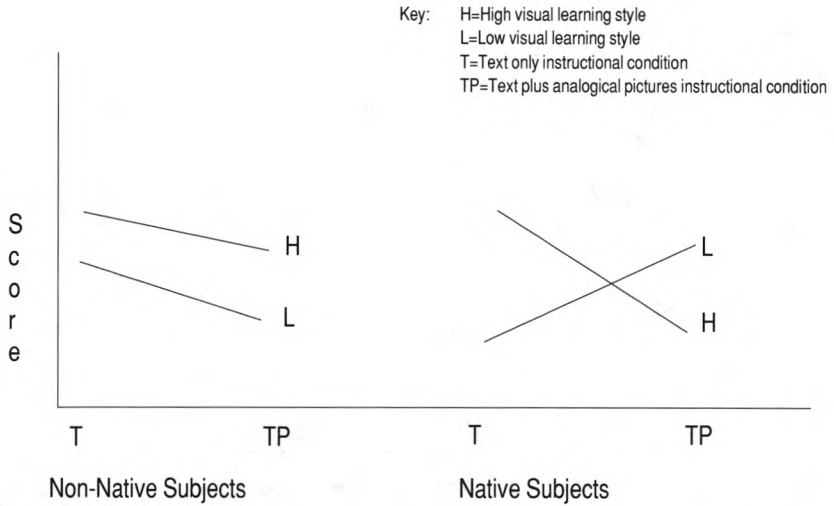


Figure 1. Comparison of tendencies of observed means of multiple-choice test post-scores (Comprehension) for non-Native and Native subjects.

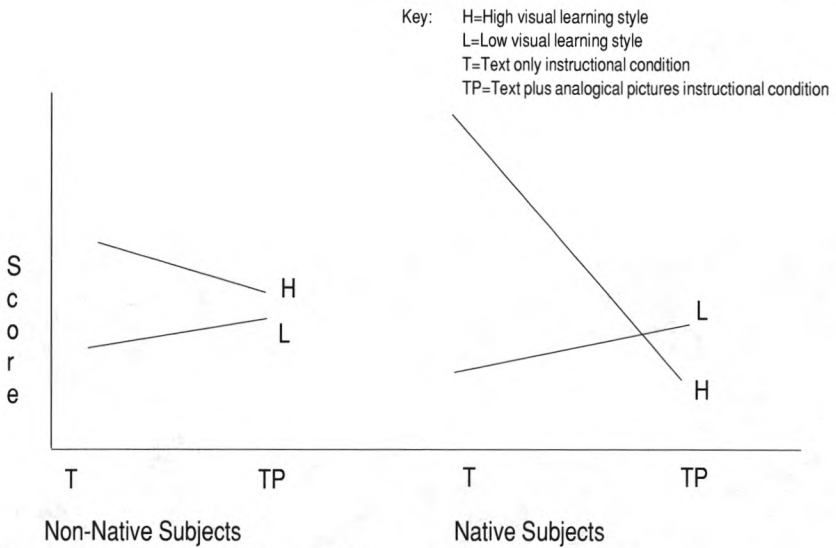


Figure 2. Comparison of tendencies of observed means of open-ended test post-scores (Knowledge) for non-Native and Native subjects.

Conclusions and Implications

Overall, these results seem to indicate that analogical pictures may serve both a positive role (perhaps as conceptual pegs for lower ability, Native subjects in the less difficult task) and a negative role (perhaps as distracting stimuli for the higher ability, Native subjects in the less difficult task and lower ability, non-Native subjects in the more difficult task). Research that compares the performance outcomes of low ability and high ability students on both lower and higher level concept acquisition lends support to this explanation (Cronbach & Snow 1977; Peeck, 1987; Winn, 1982).

The following conclusions and implications about two key components of the design of instruction (learner and learning task) can be drawn from the findings of this study.

The Learner Component of Instruction

A number of cognitive variables affect learners' ability to acquire new information. Text-based, self-instructional materials for pre-college/university adult learners should take into consideration the strength of learners' verbal and spatial cognitive processing skills, as well as the amount of relevant knowledge that learners bring into the learning situation. Cultural background (specifically, North American Native) appears to influence the way learners' process information in terms of the particular set of abilities used to complete tasks of varying difficulty.

The Learning Task Component of Instruction

The acquisition of less difficult (i.e., knowledge) versus more difficult (i.e., comprehension) concepts is differentially affected by the presence of analogical pictures, depending on learners' learning style. Although less difficult concept acquisition is negatively affected for high visual learners and positively affected for low visual learners, in general the opposite is true for more difficult concept acquisition. The former pattern appears to be more the case for Native learners in both levels of concept acquisition.

These findings provide support for a compensatory model of instructional design (Corno & Snow, 1986; Cronbach & Snow, 1977) suggesting that text-based, self-instructional materials for low verbal and low visual adult learners could be improved by the addition of analogical pictures. These findings also point out the importance of carefully assessing the potential interactive effects of all key instructional variables, as opposed to focusing on each in isolation, thus avoiding the tendency to stereotype learners.

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