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The Effect of Electronic Evaluation Tools on Types and Magnitudes of Learning

Suzanne Daningburg
Richard F. Schmid

Abstract: The effects of use and non-use of a particular electronic formative evaluation tool, the Program Evaluation Analysis Computer (PEAC) system on the cognitive, affective and evaluative aspects of college students' perception of an educational television (ETV) program emphasizing cognitive learning were investigated. A specific real-time evaluation question was used for Study 1 and a more global question for Study 2. Scores for theshort answer test assessing content recall in Study 2 increased from pretest to posttest for non-users and decreased for users, suggesting that PEAC usage hindered recall involving comprehension. No other PEAC effects were found. The results suggest that while electronic evaluation techniques may be well suited for evaluations involving affective aspects of ETV programs, they may not provide useful evaluation information when objectives emphasize cognitive change, and may actually interfere with some types of learning. Formative evaluation factors Influencing categories of learning are discussed.

Resume: lei, nous avons etudle les effets qu'ont 1'utllsation et la non-utilisation d'un outil d'evaluatlon formative specifique, le systeme devaluation de programme «PEAC», sur les aspects cognitifs, affectifs et evaluatifs de la perception qu'ont les etudiantsde niveau collegial du programmede television educative«ETV» qul porte sur l'apprentlssage cognitlf. Une question specifique en temps reel a et6 utllisee dans l'etude No.l et une question plus globale dans l'etude No. 2. Dans l'etude No.2, les scores obtenus, en reponse aux questions a reponses breves portant sur 1'evaluatlon du contenu retenu, ont augmentedu pretest au post-test pour les non-utilisateurs mals dlminue pour les utilisateurs. Ce resultat laisse supposer que 1'utllisatlon du PEAC est un obstacle a la retention qui demande une comprehension. Aucun autre effet reli6 au PEAC n'a ete releve. Les resultats suggerent que, blen que les techniques d'evaluatlon informatisees peuvent etre parfaitement utiles dans revaluation des program mes ETV com portant des aspects affectifs, elles ne peuvent peut-etre pas donner une evaluation valable quand les objectifs mettent en valeur lechangement cognitif, Elles pourraient memeentraver certaines formes d'apprentissage. Les facteurs devaluation formative pouvant influencer les genres d'apprentissage y sont egalement trait6s.

In the field of educational technology, the breadth and potential sophistication of media applications has dramatically increased the need for formative evaluation of educational and training processes and products. A number of works have delved into the history (Cambre, 1981), methods (Weston, 1986),

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definitions (Scriven, 1967; Dick, 1980; Gooler, 1980) and tools (Millard, 1992) of formative evaluation. While this literature provides a solid descriptive and methodological foundation for classic implementation of formative evaluation, dramatic changes in instructional design have necessitated the conscious re-examination of the evaluation process. For example, front end analytic approaches such as performance and needs analyses have expanded the purview of educational technology to include all aspects of the target system, not just the student and content (Rosenberg, 1990). Techniques and tools as diverse as rapid prototyping and small format video are bringing designers, developers and end users closer and closer together, necessitating the evaluation of the entire learning system (Daningburg & Schmid, 1988). Alongside these systems, powerful, electronically-based design and evaluation instruments have been developed which are fundamentally changing how we conceptualize and develop learning products and engineer their use.

The purpose of the present studies was to focus on these new electronic evaluation tools, and examine their utility in media development. Measurement tools such as computer-based, on-line audience response systems are now a standard part of educational television production. These electronic systems provide designers and researchers with virtually instant access to viewer reactions to the content being presented, and are demonstrably powerful in yielding accurate, affective information on viewer preferences (Baggaley, 1982). These tools have encountered remarkable success at providing information with face and content validity (i.e., samples from the target population tell us exactly what they think moment by moment, and revisions are made accordingly). However, the value and effect of these tools in terms of empirical or construct validity are more difficult to ascertain, and virtually no empirical research has addressed these issues. Of general concern is the extent to which these tools, by their very presence, alter the phenomenon they are measuring. The validity of their output, as utilized in the instructional design process, thus warrants scrutiny.

Electronic Measurement Methodologies

In order to understand the potential role of electronic measurement tools in instructional design, it is first necessary to describe them. Typically, these systems electronically gather second-by-second reactions from individual viewers to single evaluation questions such as "How interesting is the program?" The data, stored in hand-held units which resemble small pocket calculators, consist of reactions from one to many viewers evaluating simultaneously. These data are dumped into a central microcomputer, aggregated and aligned with each moment of the program. The output, including the superimposition of real-time viewer responses over an entire program or segment, is specially designed for meaningful input to program production decisions (Nickerson, 1979). Fine-grain analyses are possible, with visual representations of viewer involvement and/or enjoyment directly linked to program dynamics (e.g., specific script lines, appearances of a given personality, scene or format change). By capturing an aspect of the viewer's immediate reaction, these systems allow for remarkable precision in quality and

degree of evaluative detail. Their key strength is that viewer reactions are time-locked to the programming which evoked those reactions. Baggaley (1982) notes, "Audience reaction can shift and change from one moment to the next, and overall reactions to a programme can be due to an isolated moment within it which even its producer cannot predict" (p. 70). These systems overcome the obtrusiveness of inserted oral or written questions (which require actual pauses in the program) and the lack of specificity inherent in a reliance on post-presentation questions.

A prime example of this type of electronic evaluation tool is the Program Evaluation Analysis Computer (PEAC) system. We selected the PEAC system as a representative tool for these studies because it has been used in a wide variety of TV-based projects (Corporation for Public Broadcasting [CPB], 1981; Radio-Quebec, 1985, 1984; Baggaley, 1982) and because it is similar to other popular electronic techniques. (See Millard, 1992, for a complete description of such tools.) While the PEAC system has been used more for formative evaluation of commercial productions than for educational materials, the growing trend to more sophisticated tools makes the use of systems such as the PEAC more and more desirable. By examining the effects of a prototypic system, some general principles might emerge regarding formative evaluation.

Electronic Evaluation and Learning System Design

Automated evaluative tools such as the PEAC system have proven useful in assessing affective variables such as viewers' interest, positive (or negative) reaction, recognition and/or empathy for actors/products, and so on (e.g., CPB, 1981). However, instructional designers and teachers are also concerned, if not preoccupied, with cognitive objectives (Clark, 1992; Daningburg & Schmid, 1988; Romiszowski, 1981). The use of audience response systems within an educational context raises two related questions. First, does their current use in assessing affective variables interfere with or distract designers from the assessment of equally or more important objectives, such as cognitive ones? Second, can these tools also be used to enhance the effectiveness and/or efficiency of the development process for cognitive content? The issue of whether electronic measurement usage affects viewers' cognitive processing is important because formative evaluators who use continuous opinion measures during viewing tend to ask comprehension questions after viewing. The evaluators usually assume a negligible interference effect (Millard, 1992). We know of no empirical research which has studied the possible obtrusiveness or interference of electronic evaluation techniques with the cognitive processes involved in learning. (See Baggaley, 1987, for a review of various continuous response factors.)

Evaluation Process and Instructional Product

In addition to examining evaluation factors within the educational production system, general variables which have some influence over the final audience response need to be highlighted. Daningburg and Schmid (1988) examined the interaction of three general components of the evaluation process of educational tools: the producer; the teacher and the learner; and the effect of this interaction

on the instructional product. Within their model, five factors were identified which seem to play an important role in learning effects: assessment objectives; individual differences; content familiarity; mathemagenic activities; and attitude and motivation. Each of these variables merits a brief comment on the context of its relation to the evaluation process.

Although the *sine qua non* of assessment objectives is that they should evaluate what they claim to evaluate, electronic techniques may not achieve this essential standard. Empirical demonstrations which establish the validity of tool usage on various types of objectives are essential. The second factor, individual differences, has long been recognized as a key determinant in the success of instruction (Bracht, 1970; Bracht & Glass, 1968; Cronbach & Snow, 1977; Snow, 1978). Notwithstanding the diminished role of Aptitude by Treatment Interaction (ATI) research in educational circles (McCain, Short & Stewin, 1991), individual differences must be taken into account in evaluating a medium increasingly targeting specific, well-defined populations and segments thereof. Third, content familiarity is a well-recognized cornerstone of the instructional design process, requiring sharp focus on learners' prior knowledge and ability. Unfortunately, familiarity is complicated by both interest level and presentation format of content (e.g., boring or fascinating; easy or difficult). The fourth factor consists of mathemagenic activities, or those student behaviors relevant to the achievement of instructional objectives in specified situations or places. Rothkopfs early work (1966; 1970) is still relevant today: he argued that by drawing attention to certain aspects of instructional content, questions asked prior to, during, or after a lesson differentially shape the student's processing and learning. Finally, attitude and motivation have an impact on learners' attention and effort in learning. Programs must have affective goals and criteria to measure them because it is difficult for any but the most highly trained professional evaluator to separate a cognitive response to a given event (or instruction, etc.) from a feeling or an opinion about it. Each of these five variables, central to the learning process, may be positively or negatively affected by electronic evaluation techniques. The purpose of this research was to assess these effects.

The Studies

As noted above, one of the main contributions of electronic evaluation tools to the process of formative evaluation is that they significantly reduce many of the obtrusive aspects of the evaluative process (Nickerson, 1979). The question addressed by these studies is what remaining (or new) obtrusiveness exists, first in the cognitive domain where instructional objectives usually reside, and in the affective domain, where the PEAC system is most often applied. In order to examine this question of obtrusiveness on the learning process, two levels of PEAC usage were utilized: learners using the technique, and learners not using it. Assuming that attention is selective, the key to assessing differences between the groups as a result of treatment depends upon the sensitivity of the dependent measures to effects resulting both from evaluation task demands (critical information to which attention is drawn) and from aspects not directly addressed in

the evaluation process (incidental information) (Anderson, 1972). These studies explored the relationship between the task demands imposed by the PEAC system and the specific content being evaluated. For example, if the evaluator were to ask learners to assess the visual quality of the program, the increased attentiveness of viewers to that aspect of the content would likely enhance their subsequent recall of it, probably to the detriment of other aspects (Rothkopf, 1970; Watts & Anderson, 1971). While this attention factor is fairly obvious, the process represents a dilemma for the evaluator. The more precise, and thus prescriptive and useful the information, the more obtrusive it becomes to other factors, regardless of the measurement technique (PEAC or otherwise). The evaluator is therefore left with measuring either global responses which preserve external validity, or specific questions which by their very nature prime attention to certain aspects while interfering with others. Thus, formative evaluation must both carefully specify precisely what it is that needs to be measured, and recognize that that decision will have an impact on the generalizability of the results.

The studies reported here were exploratory in that they attempted to integrate several areas of inquiry which seemed to be logically related. The major effect expected was that use of the PEAC system would influence cognitive recall in certain conditions. (In the interest of clarity we report the studies in terms of the actual variables used in analyses, rather than in terms of the initial design. Readers wishing complete information are invited to contact the first author for details.)

METHOD

Design

A Pretest-Posttest Control Group fixed design was used, with the Usage (use or non-use of PEAC) factor between subjects. The pretest used to determine content familiarity was used again as the posttest, leaving open the possibility of including a repeated measures comparison. While the same design was used for two populations, described below as Study 1 and Study 2, each population received a different overall evaluation question.

Subjects

The subjects in Study 1 were 55 students from a private urban college. For Study 2,69 students from a public urban college were used. Since subjects' prior knowledge of content was assessed via a pretest rather than manipulated, random assignment of groups was preserved, thus avoiding the limitations associated with an ex post facto design.

Materials

The instructional stimulus consisted of a 27-minute Educational Television (ETV) program entitled "Out of the Mouths of Babes", produced in 1975 by the Canadian Broadcasting Corporation (CBC) and previously aired on the weekly

'The Nature of Things" television series. The program examined the theory that a child's ability to talk is partly innate; that babies are born with the capacity to extract not just words, but rules of grammar, from what they hear spoken around them. This particular program was selected for three reasons. First, its content and level of production were appropriate for college-level students. Second, it was believed that the content would be familiar to some students and unfamiliar to others, allowing an adequate number of learners in each level of content familiarity. Third, the program was considered a good representation of a typical ETV program in that it was of relatively high production quality and it dealt with an academic, though popular subject matter.

The pre-test measures consisted of a two-part prior knowledge cognitive test and an attitude questionnaire. Prior knowledge was assessed by two composite measures, one based on 6 short answer items and the other on 10 multiple choice items. The items tested levels of knowledge, comprehension and application of program content. The attitude measure consisted of 14 scaled Likert-type questions which were related to subjects' attitudes toward the importance and relevance of language acquisition in children. Each attitude item dealt with a discrete topic, and was therefore treated individually.

For the first session, the experimenter orally presented instructions for each of the pre-treatment measures, information about program viewing and a request to complete a post-viewing questionnaire to all groups. For the experimental sessions one week later, the experimenter requested that students watch the program, and gave instructions regarding each of the post-viewing questionnaires. In addition, those groups using the PEAC system were instructed verbally in the use of the PEAC devices.

For Study 1, all subjects were told that the overall question to be used in evaluating the program was: "How effective do you think this program is in demonstrating language acquisition in children?" The question was designed to prompt learners to attend to the academic objective of the presentation, namely, the presentation of instruction about childrens' language acquisition. Subjects using the PEAC system were asked to rate the program in terms of this overall question, using their hand-held devices. Possible responses were: 'Very effective"; "fairly effective"; "not very effective"; and 'Very ineffective". Subjects not using the PEAC system were simply asked to keep the question in mind as they viewed the program.

It was initially intended to use the same overall (real-time) question for both samples. However, during Study 1 it was found that the interaction between this question and the characteristics of the program failed to provide for discriminating evaluation. Nearly all subjects using the PEAC system rated the film as 'Very effective" or "fairly effective" at all times and in fact used their hand-held PEAC devices very infrequently. The decision was made to change the overall question for Study 2. All subjects for Study 2 were told that the overall evaluation question was: "How good do you think th is program is, based on your overall reaction?" This question was similar to the general content evaluation typically used in much of Baggaley's work. Subjects using the PEAC system were asked to: "Kate the

program as very good, fairly good, not very good or poor. Use your own judgment to make the evaluation, based on anything that strikes your overall reaction at any given moment." Once again, subjects not using the PEAC system were asked to keep the question in mind during viewing. It was hoped that the change of question would accomplish two goals. First, the more global nature of this question would encourage students to be more discriminating about different aspects of the program. Second, the simpler, more understandable phrasing would make the task easier and thus encourage more frequent responses. For both studies, in classes using the PEAC system, the questions and possible ratings were written on the blackboard as a reminder to subjects throughout the program.

The post-presentation dependent measures consisted of five parts. The cognitive and affective measures given in the pre-presentation session were re-administered. An additional section was attached to the cognitive component of the posttest. It was thought that this measure might provide a more precise indication of the relative obtrusiveness of the PEAC system. Subjects' own opinion about the effectiveness of the program was sought through 20 program evaluation rating questions. These were different from the attitude measures in that the program evaluation questions tapped opinions about the presentation of this specific program whereas attitude items probed opinions related to the general topic — that is, language acquisition—apart from the ETV program. The items in the program evaluation rating section, designed to measure opinion about the actual program, varied in nature, with some having a short answer format, some a multiple choice format, and others a Likert-type scale format. Finally, 16 demographic questions ascertained information such as age and sex.

Procedure

Study 1 involved three intact classes, two of which made up the experimental group (re = 16 + *n* = 13), thus (n=29), and one control (n=26). Study 2 also involved three intact classes, two of which made up the experimental group (*n* = 23 + *n* = 17), thus (*n* = 40), one control (*n* = 29). Any potentially different learner characteristics were assumed to have been distributed in random fashion, since the three intact classes in each of the studies consisted of different sections of the same course, and were taught by the same instructor. The students had been placed in a given section on the basis of their college's scheduling system, so that confounding group differences were highly unlikely.

At the first session the regular instructor introduced the experimenter, who gave a brief introduction about the study, and distributed large envelopes containing the pre-treatment questionnaires. Students were asked to complete the questionnaires, according to ensuing verbal directives and written instructions. Time limits were imposed for each questionnaire. When all questionnaires had been completed, students returned them to the experimenter. Students were told that the second session would occur in one week.

One week later, all groups were given an identical introduction to the ETV program. Subjects were informed that they would be asked to answer questions after viewing. In addition, experimental groups (i.e., those using the PEAC system) were given oral instructions on the use of the PEAC system (including an explanation of the overall real-time question as mentioned above). The program was shown, after which three questionnaires were distributed to each student. Once again, students were asked to complete the questionnaires according to verbal directives and written instructions, and a time limit was imposed. When finished, students returned the questionnaires and the experimenter answered any questions about the study.

RESULTS

Scoring Procedures for Dependent Variables

The two cognitive tests, the short answer format and the multiple choice format, were used as measures of content familiarity in the pretest. The six short answer items were assigned 2 points for each correct response, and only one point was given for partially correct answers. An inter-rater reliability coefficient of .91 was obtained for the short answer items. The ten multiple choice items were assigned one point for each correct response. Each item in the attitude questionnaire was coded individually, with a value from one to five to each of the responses.

The cognitive posttest consisted of the same two measures that were used in the pre-treatment session, and were scored the same way. An additional test, designed to further explore the relation between use of the PEAC system and different types of learning, consisted of 11 fill-in-the-blank type questions related to incidental learning. A total of 26 points was possible, with partial credit given to responses containing fewer than the total concepts or words required. The attitude posttest was identical to that of the pre-treatment sessions and was scored in the same manner. Demographic information was also collected and tabulated.

Tests of Assumption

Due to the need to employ intact classes within each study, equivalence of groups was assessed prior to the analyses of effects. Analyses of variance (ANOVAs), completed on the three classes of each study for all of the pre-session dependent measuring instruments yielded no differences, thus verifying class equivalence within each study.

Study 1

Study 1 involved data from the private college sample only. The sample from the public college (Study 2) was significantly different from its private counterpart on pretest performances, thus amplifying the need for separation of the two groups.

Means and standard deviations for the three cognitive variables—short answer, multiple choice and incidental learning scores—are listed in Table 1. Results of multivariate and univariate analyses of variance yielded no significant results.

TABLE 1
Cognitive and Aptitude Measures for Study 1

Criteria	With PEAC			Without PEAC		
	X	SD	n	X	SD	n
Pretest						
Short answer	3.83	1.42	29	3.50	1.45	26
Multiple choice	3.10	1.57	29	2.81	1.50	26
Posttest						
Short answer	4.38	2.24	29	3.77	1.56	26
Multiple choice	7.90	1.52	29	8.00	1.50	26
Incidental	15.59	2.77	29	16.12	3.30	26

For the attitude items, each of which dealt with different components of the program and content, Chi-square and Mann-Whitney U tests were used. No significant differences between use and non-use groups were found for either the attitudes expressed on the pretest or those expressed on the posttest. Despite the ordinal nature of scores on the attitude items, a repeated measures analysis of variance was conducted in order to determine whether or not any changes occurred from the pretest to the posttest within each group. A total of 7 cases were deleted from the experimental group, while 2 cases were deleted from the control group due to missing data. None of the response distributions was statistically significantly skewed. Results from this analysis yielded results similar to the non-parametric analyses mentioned above. For example, both use and non-use groups expressed the opinion that television was a desirable medium by which to learn about topics like language acquisition; and both groups also shared the attitude that the documentary format was not necessarily appealing, after viewing the ETV program.

No significant differences were found for any of the program evaluation rating questions (which probed viewers' opinion about the particular program itself rather than their attitude about the topic and television in general), using Chi-Square tests.

Study 2

The results of Study 2 were based on data from students at the public college. The specific tests dealing with cognitive recall, attitudinal responses, and

program evaluation ratings were identical in all respects to those of Study 1.

Means and standard deviations for the three cognitive variables — short answer, multiple choice and incidental recall — are listed in Table 2.

TABLE 2
Cognitive and Aptitude Measures for Study 2

Criteria	With PEAC			Without PEAC		
	X	SD	n	X	SD	n
Pretest						
Short answer	2.65	1.48	40	2.35	1.52	29
Multiple choice	1.90	1.15	40	2.36	1.25	29
Posttest						
Short answer	2.05	1.65	40	3.41	1.99	29
Multiple choice	5.60	1.78	40	6.18	1.49	29
Incidental	13.23	4.46	40	13.66	5.02	29

A multivariate analysis of variance (MANOVA), using the short answer and the multiple choice scores of the pretest and the posttest as dependent variables, resulted in a significant Retelling test ($F(l,63)=3.73, p=.009$) for the main effect of PEAC usage. No other overall effects were significant. Within the PEAC effect, univariate analyses showed the short answer scores to be significant ($F(l,66)=10.26, p=.002$\ while the multiple choice scores only approached significance ($F(l,66)=3.5$, $p=.066$), both on the posttest only. Table 3 represents the multivariate and univariate comparisons for these dependent measures.

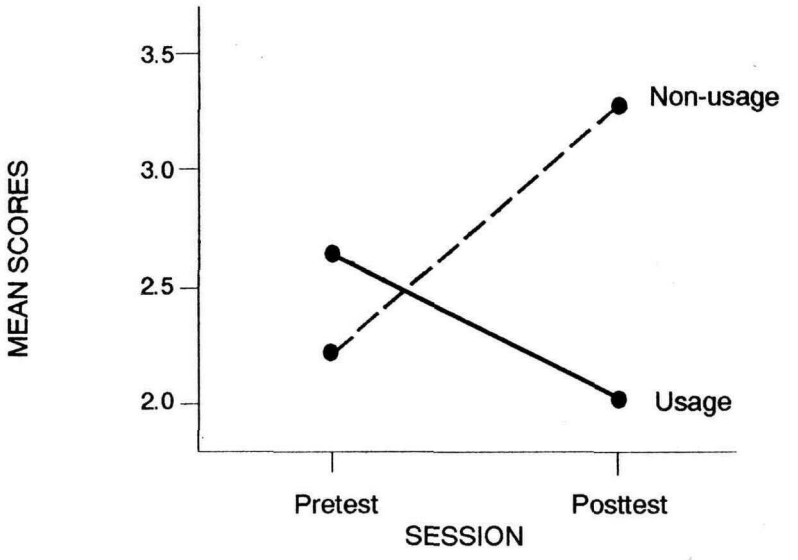
These analyses showed that, based on the short answer posttest scores, non-users of PEAC outperformed users of PEAC.

The above MANOVAs provided essential information regarding the central hypothesis of the study, namely, that use of the PEAC system influences cognitive recall. In order to further examine the nature of this influence, overall pretest performance was used as a baseline and compared to posttest performance. Thus, a repeated measures analysis of variance with the short answer pretest and posttest scores as the repeated measures and PEAC usage as the treatment factor was performed. The results produced a significant interaction ($F(1,66)=11.64$, $p=.001$). While both experimental and control groups performed at the same level on the pretest, the control group, which was not distracted by the PEAC evaluation, improved significantly (Tukey, $q(67)=4.06$,/><.01) and the experimental group actually performed slightly worse on the posttest. On the posttest comparison, the control group also performed significantly better than the experimental group (Tukey, $q(67)=5.56, p<.01$). A graphic representation of this interaction appears in Figure 1.

TABLE 3
Multivariate and Univariate Tests on Short Answer Pretest (SAPRE), Multiple Choice Pretest (MCPRE), Short Answer Posttest (SAPOST), and Multiple Choice Posttest (MCPOST) Scores for Study

Effect	Multivariate test (Hotelling's)			Univariate tests Error Mean Square: SAPRE 2.27, MCPRE 1.39, SAPOST 3.24, MCPOST 2.84			
	F	df	*p*		F	df	P
PEAC	3.73	(1,63)	.009	SAPRE	.63	(1,66)	.429
				MCPRE	1.89	(1,66)	.174
				SAPOST	10.26	(1,66)	.002
				MCPOST	3.50	(1,66)	.066

Figure 1.
Mean Scores on Short Answer Pretest and Posttest for Usage and Non-Usage of PEAC for Study 2.



As in Study 1, attitude items were examined individually using non-parametric analyses. Mann-Whitney U tests on each item showed that on the pretest the PEAC usage group attached significantly more value to the importance of language acquisition in children than did the non-use group. No significant differences between groups were found for attitudes indicated on the posttest.

In order to assess changes in attitudes from pretest to posttest within groups, a repeated measures analysis of variance was performed. Due to missing data, 12 cases were deleted from the experimental group, while 6 cases were deleted from the control group. None of the response distributions was statistically significantly skewed. As in Study 1, both the use and the non-use groups seemed to share certain attitudes. For example, two items indicated that after viewing the program, students expressed a more negative attitude toward the importance and/or relevance of language acquisition in children.

Results from the Chi-Square tests performed on the program evaluation rating questions showed no overall differences between groups.

DISCUSSION

The study's central hypothesis, which stated that the use of an electronic evaluation technology would influence cognitive learning, was supported for content recall when a general real-time evaluation question was used. What also emerged, however, was the realization that the validity of the evaluation process and outcomes is largely determined by the context within which the evaluation is carried out. A given evaluation tool may be appropriate for certain situations, and inappropriate for others. What is therefore needed are guidelines for determining when and where electronic tools such as thePEAC system are useful.

This discussion will return to the five principle contextual factors cited from Daningburg and Schmid (1988) above — assessment objectives, individual differences, content familiarity, mathemagenic activities, and attitude and motivation — to interpret the results.

Assessment Objectives

In looking at assessment objectives, two critical questions must be addressed. First, what are the intended learning outcomes of aproduction? And second, what is it that is being evaluated? The results of these studies suggest the direct involvement of these contextual factors with the task demands placed on learners. In the initial stages of this research, we assumed that the act of holding the hand units and being asked to evaluate would affect cognitive learning. Looking at the global results, however, it seems that simply holding the hand units and being asked to evaluate is not what differentiates the obtrusiveness of the PEAC system methodology from traditional techniques, nor what defines the task demand of evaluative viewing. Study 1 PEAC users hardly ever used their hand units during the program, and not surprisingly, no differences emerged.

This suggests that the critical task demand seems to be defined, not by the electronic tools themselves, but by the evaluation question (i.e., the overt request of directed attention). The question for Study 1 appears to have been either too complicated or too general for viewers to keep in mind while simultaneously watching the program. The question had no effect on their attention. If the learners indeed were continuously evaluating, the fact that they seldom changed their opinion renders the question inappropriate because it failed to provide information useful for formative evaluation of the program.

The simpler phrasing of the question used for Study 2, relative to the question used in Study 1, was designed to make the task easier and thus encourage more frequent responses. The question did produce an effect, suggesting that the question itself plays a crucial role in both whether people respond, and, consequently, on the obtrusiveness of the PEAC methodology. This research also suggests that cognitively oriented questions will not function well within an ETV context, as moment-by-moment changes are unlikely to emerge.

Individual Differences and Content Familiarity

Although the real-time question in Study 2 produced an increase in response rate, we suspect that the nature of the program itself led to the learners' failure to use the hand units often in both studies. As mentioned above, one of the reasons for the selection of the particular program used was that it was considered a good representation of an ETV program, offering both good entertainment and learning value. It is clear, however, that viewing of this type of ETV is not a highly affective activity. A typical program would probably not elicit the individual attitude peaks and valleys of a program dealing with a controversial subject matter or a program designed largely to entertain. In other words, this type of ETV does not usually bring out strong opinions about anything on a moment-by-moment basis.

For cases in which frequent responses are not elicited, post-presentation evaluation techniques seem the best alternative. While the use of the PEAC system does not preclude the use of post-presentation techniques (in fact, to the authors' knowledge, the system is always used in conjunction with post-viewing questionnaires), the cost and effort of using an electronic evaluation system seems worthwhile only if useful additional information is obtained. Furthermore, the level of obtrusiveness, especially at increasing levels of responding as evidenced in Study 2, may obscure the evaluation of the principle aim of the program, that is, cognitive learning. If the PEAC system is used because the ETV program is felt to have sufficient affective variability, the measure of cognitive effectiveness should probably be conducted separately (without moment-by-moment electronic measurement methodology).

Mathemagenic Activities

Based on Rothkopf s work, we conjectured that requiring learners to evaluate continuously throughout a program would direct their attention to certain aspects of the program, leaving other aspects unnoticed. The Study 1 question did

not have the positive effect on content recall that mathemagenic theory would have predicted. The question for Study 2 actually appeared to have a negative impact. The detrimental electronic evaluation effect only emerged in the short answer responses, which are more discriminating of comprehension and application levels of learning. This result suggests that use of general moment-by-moment evaluation influences an individual's deeper processing of information as opposed to simple information acquisition.

The verbatim-type questions used in the studies to assess incidental learning did not seem to be influenced by the use of electronic evaluation tools. This may be because this type of recognition item does not require conscious cognitive processing in the same manner as does short answer material involving comprehension.

Attitude and Program Evaluation Ratings

There were no differences between PEAC users and non-users for any of the attitude items. In general, viewers appear to both approve of and recommend this form of a documentary in the context in which they found themselves, that is, watching ETV in the classroom. The studies show, however, that simply liking a documentary does not necessarily imply that learning will occur, as evidenced by the mediocre achievement on several parts of the posttest. This again highlights the need for designers and producers to attend to an intentional balance of various types of objectives in the design and evaluation of instructional programs.

CONCLUSIONS

Electronic assessment tools in general, and the PEAC system in particular, have been advocated as not artificially changing the act of viewing (Millard, 1992; Radio-Quebec, 1984). These studies provide support for the claim that electronic evaluation tools may be used in a valid fashion for measuring affective variables, the domain of their traditional application. This assumes that the objectives of the program include change in attitude as a central goal. However, these results provide empirical evidence to suggest that such tools are not appropriate in the assessment of a program's cognitive learning effectiveness, and indeed that they detract from it. Given that cognitive objectives are of paramount importance to educators, this interfering effect appears to seriously question the validity of using electronic measurement tools at the same time data are sought on cognitive processing.

We are reminded that, while the data produced by these systems tend to be impressive in a technological sense, it would be a mistake to generalize their use beyond their empirically demonstrated abilities. In situations in which a program's objectives are partly concerned with affect and partly with cognitive change (i.e., learning), we suggest that an evaluation using an electronic tool be

supplemented by another evaluation technique more appropriate to assessing cognitive change, such as post-viewing questionnaires.

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Le vidéodisque et l'apprentissage : une recension des recherches

Murielle Dalpé

Résumé: Cette recension des écrits porte sur l'apprentissage au niveau universitaire dans unesituatlon d'enseignement assisté par vidéodisque. Elle couvre une période d'une dizaine d'années. L'application de certains critères a permis de retenir 45 études. Selon le cas elles sont classées d'après l'évaluation effectuée au prétest post-test ou au post-test ou d'après le plan expérimental factoriel ou la mlse à l'essai de matériel nouvellement développé. Les variables dépendantes s'intéressent à la performance des sujets, au temps consacré à l'étude, aux attitudes vls-^-vis ce moyen d'enseignement. D'autres tentent de vérifier l'influence des différences individuelles des étudiants ou des caractéristiques de l'enseignement sur l'apprentissage. Cette vue d'ensemble des études relève certaines déficiences apparentes des écrits scientifiques, ce qui en diminue leur utilité, Cet article veut contribuer à l'amélioration de la méthodologie de la recherche qui s'intéresse aux médias d'enseignement. Il cherche aussi à consclentlser les chercheurs à la communication complète des conditions expérimentales,

Abstract: This crltical study focuses on videodisc-aided instruction at thé University level. This study spans over a period of 10 years. Through the application of spécifie criterla 45 studies were chosen. They hâve been classified accordlng to thé évaluation mode at the pré-test post-test stage or at thé post-test stage or, accordlng to a factorlal expérimental plan or again, through thé testlng of newly developed materiel. The dépendant variables pertaln to thé performance of thé subjects, to the tlme dedicated to thé study and to attitudes adopted towards this teaching method. Others endeavoured to verify thé Influence on thé learnlng process of thé teaching method or thé students' individuel characteristics. This overview brings to light some apparent deficiencies in thé written scientlfic matériel whlch diminlshes their usefulness. This article would llke to contribute to thé improvement of thé research methodology dealing with teaching médias, It also wants to make researchers aware of thé importance of thorough communication of expérimental conditions.

Les nouvelles technologies apparaissent à un rythme accéléré. Les étudiants exigent de plus en plus d'interactions avec les moyens d'enseignement mis à leur disposition. Afin de répondre aux différentes façons d'apprendre, les professeurs doivent mettre au point de nouvelles stratégies d'enseignement et d'évaluation. Les concepteurs n'ont pas à leur disposition suffisamment de connaissances théoriques sur lesquelles ils pourraient s'appuyer dans leur développement de matériel d'enseignement.

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L'intégration de nouvelles technologies d'enseignement fait ressurgir d'anciens problèmes d'enseignement non encore résolus et en soulève de nouveaux. Même si le domaine de la technologie en éducation est prolifique en recherches, plusieurs réponses restent encore à trouver. Plus encore, la méthodologie utilisée fait l'objet d'opinions divergentes. Malgré tous les arguments déclinant l'influence des médias sur l'apprentissage ou la motivation, plusieurs tentent encore de la mesurer à un niveau macroscopique. L'enseignement assisté par vidéodisque comparé à d'autres méthodes ou à d'autres médias en est un exemple. On en obtient un bon répertoire en consultant les recensions d'écrits et les méta-analyses sur ce sujet (Bosco, 1986; Cushall, Harvey & Brovey, 1987; De Bloois, 1988; Evans, 1986; Fletcher, 1989; Haynes, 1986; Manning, Ebner, Brooks & Balson, 1983; McNeil & Nelson, 1991; Siée, 1989; Winkler & Polich, 1990).

Depuis plus de dix ans ces macro-questions de recherches s'intéressent à l'identification des effets généraux de l'intégration du vidéodisque en situation d'apprentissage. Les chercheurs s'interrogent sur son efficacité, se préoccupant peu des causes de celle-ci. De plus, la difficulté de pouvoir extrapoler sur les effets obtenus diminue considérablement l'utilité de ces études.

Les incitations au changement des pratiques de recherche se faisant pressantes, trois modèles théoriques de référence apparaissent vers la fin des années 1980 (Clark & Sugrue, 1988; Hansen, 1989; Kozma, 1991). Ces modèles veulent contribuer à l'identification des caractéristiques qui ont un impact sur l'apprentissage, soit celles de l'apprenant, de la tâche d'apprentissage et des méthodes d'enseignement. Ces modèles viennent à point puisque de nouvelles technologies de plus en plus interactives voient le jour. Pensons seulement à l'ordinateur jumelé à la télévision, au vidéo, au vidéodisque ou plus récemment, à l'un des différents disques compacts. En éducation, l'interactivité technique offerte par les médias ne suffit pas à elle seule à rendre l'enseignement médiatisé interactif. Il faut de plus y associer une pédagogie adaptée à la tâche et aux différences individuelles des utilisateurs. Cela signifie entre autres que l'interface doit s'adapter à ses besoins (et non l'inverse) et qu'il puisse aborder le contenu selon différentes approches. Il devient urgent que les chercheurs portent une attention spéciale à l'interaction des caractéristiques des médias avec celles de l'apprenant et de la situation d'apprentissage dans laquelle il se trouve. L'étude à un niveau microscopique de ces interactions semble la voie appropriée à l'émergence de lois et de théories dans ce domaine (Cronin et Cronin, 1992).

Les recensions d'écrits mentionnées plus haut comportent deux difficultés d'ordre méthodologique. La première concerne les niveaux d'enseignement. Ces recensions considèrent dans un même ensemble des études effectuées depuis la maternelle jusqu'au niveau universitaire en passant par la formation du personnel en entreprise. Les objectifs d'apprentissage poursuivis par ces enseignements et surtout le degré de maturité et d'habiletés cognitives des sujets ayant collaboré à ces expérimentations semblent trop variés pour les considérer en un tout.

Une deuxième difficulté consiste à englober dans une même étude la vidéo interactive avec le vidéodisque interactif ou non et l'hypermédia. Il s'agit en fait

de plusieurs médias car la vidéo interactive recherche l'information avec lenteur alors que le contraire vaut pour le vidéodisque. Le temps d'accès à l'information constitue une variable dont il faut tenir compte. Basé sur une structure non linéaire de l'information, l'hypermédia est construit à partir de "noeuds" d'information et de 'liens" entre ces noeuds. Il se veut une tentative de réponse aux besoins de contrôle de l'apprentissage exprimés par les étudiants. Ces hyperespaces constituent cependant un environnement où il est facile de se perdre. La surcharge cognitive et la désorientation sont les deux principaux problèmes observés (Nielson, 1990; Schneiderman & Kearsley, 1989). L'interactivité hypermédiatisée constitue plutôt un terrain de recherches axées principalement sur le design de l'interface permettant le contrôle de l'apprentissage et sur l'organisation de la structure de l'enseignement (Nielson, 1989). Le vidéodisque et le disque compact sont alors seulement des moyens au service du système hypermédia.

La présente recension des écrits porte uniquement sur l'enseignement de niveau universitaire lorsqu'il est donné au moyen du vidéodisque jumelé ou non à un ordinateur. Elle présente un inventaire descriptif des études effectuées depuis plus d'une décennie. À cette fin, elle met en évidence les principales variables étudiées de même que des informations reliées à la méthodologie et aux résultats. Quatre tableaux regroupent ces différentes études. Les recensions d'écrits mentionnées plus haut ne peuvent se prononcer de façon précise sur l'interaction de certaines caractéristiques humaines, techniques et pédagogiques dans un apprentissage assisté par vidéodisque. Cette recension ne fait pas exception puisqu'un grand nombre d'études se préoccupent plutôt de l'impact général du vidéodisque sur les acquisitions des étudiants. En identifiant quelques faiblesses des publications scientifiques, elle veut plutôt contribuer à l'amélioration de la méthodologie des recherches sur les médias. Elle cherche aussi à conscientiser les chercheurs à la communication complète des conditions expérimentales.

METHODOLOGIE

Cette section décrit brièvement les procédés mis en oeuvre pour répertorier, choisir et classifier les études pertinentes.

Source de données

Une recherche bibliographique dans les bases de données *a* permis de répertorier un grand nombre d'études sur le sujet. Les index bibliographiques consultés sontles suivants: *British Education Index, Canadian Education-Index, Comprehensive Dissertation Index* (CDD, *Current Index to Journals in Education* (CIJE), *Dissertation Abstract International, Education Technology Abstracts,* EDUQ (Bibliographie analytique sur l'éducation au Québec), *Index Medicus* (Medline), *Resources in Education* (ERIC).

Les travaux de recherche couvrent une période d'environ dix années débutant peu de temps après l'introduction sur le marché du vidéodisque au laser. Pendant ce temps, plusieurs organisations tentent de vérifier si les valeurs accordées à cette technologie s'avèrent réelles et comment le vidéodisque peut répondre à leurs besoins d'enseignement et de formation.

Deux obstacles viennent compliquer la sélection des écrits pertinents au sujet de cette recherche. D'une part, les nombreuses disciplines couvertes constituent la richesse et en même temps la difficulté à s'informer à propos du vidéodisque et de l'apprentissage. D'autre part, les mots clefs utilisés dans les bases documentaires peuvent quelquefois englober un seul ou plusieurs concepts. Il s'agit notamment de la vidéo interactive, du vidéodisque interactif ou linéaire, des disques compacts, de ITiypertexte et de Hiypermédia.

Critères de sélection des études et variables retenues

Toutes les études retenues aux fins de cette recension des écrits répondent aux critères suivants: *premier critère :* elles concernent les niveaux d'interactivité technique I, II et III du vidéodisque tels que décrits par le *Nebraska Videodisc Group* (Nugent, 1988), sans toutefois tenir compte de la vidéo interactive et de l'hypermédia. Pour plus de clarté, le niveau I d'interactivité permet de choisir et d'accéder rapidement à n'importe quelle information contenue sur le vidéodisque. Certains contiennent des codes d'arrêt à des endroits spécifiques. L'utilisateur peut alors continuer sa consultation de façon linéaire ou se déplacer à un autre numéro d'image. Le microprocesseur intégré au lecteur de vidéodisque du niveau II d'interactivité offre en plus des possibilités limitées de branchement et de traitement de réponses. Le programme informatique est dans ce cas inscrit sur une des pistes audio du vidéodisque. Le niveau III d'interactivité procède au moyen d'un programme informatique contenu dans la mémoire d'un micro-ordinateur et d'un lecteur de vidéodisques situé en périphérique. L'interaction technique de la banque d'images et de sons jumelée à l'ordinateur ajoute de nombreuses possibilités de branchements et d'analyse. Les applications faisant appel à la simulation et à la résolution de problèmes sont possibles à ce niveau. *Deuxième critère:* les résultats mesurés quantitativement proviennent des recherches publiées et accessibles réalisées au niveau universitaire seulement, depuis le début de l'intérêt envers ce média d'enseignement. *Troisième critère:* le nombre total de sujets ayant participé aux études est supérieur à 30. *Quatrième critère:* les informations fournies concernant la méthodologie utilisée sont explicites. Il n'a pas été possible de tenir compte des caractéristiques spécifiques aux groupes et à l'enseignement à cause du peu de renseignements à ce sujet dans les comptes-rendus de recherches.

Les variables retenues dans cette recension des écrits se rapportent à la performance des étudiants, au temps qu'ils consacrent à leur apprentissage, à leur attitude vis-à-vis ce moyen d'enseignement, à leur motivation à l'étude de même qu'à l'influence de leurs antécédents sur l'apprentissage.

Construction d'une banque de données et indexation

Les études sélectionnées répondent aux critères et aux variables de cette recension des écrits. Toutes les informations pertinentes sont ensuite consignées dans une banque de données informatisée. À cet effet, le progiciel DBASE s'avère approprié, en raison surtout de ses possibilités de mise àjour, de tri et d'indexation d'une grande quantité d'informations. Ces dernières concernent *la méthodologie de la recherche, l'enseignement, l'application de la technologie du vidéodisque et les résultats de recherches.* La banque de données finale comprend plusieurs études dont 45 seulement répondent aux critères mentionnés plus haut.

Les éléments d'information les plus pertinents à l'analyse de ces recherches servent ensuite à l'indexation des données. Le but consiste à effectuer des regroupements par catégories afin de les soumettre ensuite à l'analyse. Certaines carences dans les écrits scientifiques se répercutent dans la construction de la banque de données. Il s'agit d'informations incomplètes relatives à la durée de l'enseignement, aux habiletés nécessaires à l'étudiant dans l'atteinte des objectifs d'apprentissage, à l'orientation scolaire des sujets et au type d'application du vidéodisque. Elles contribuent à diminuer les possibilités d'indexation.

RESULTATS ET ANALYSE

Vue d'ensemble

Une grande partie de ces études comparent l'enseignement donné par le vidéodisque avec d'autres méthodes ou d'autres médias d'enseignement. Le terme enseignement traditionnel est le plus souvent utilisé pour les désigner. Il s'agit en fait du matériel habituellement employé dans les cours ou au laboratoire qui sert à l'enseignement au groupe de contrôle. Plus récemment, des études s'intéressent à l'influence des caractéristiques des étudiants ou de l'enseignement sur l'apprentissage. Le style cognitif et les stratégies d'enseignement sont les plus populaires suivies par le regroupement des étudiants. D'autres portent sur le contrôle de l'enseignement laissé à l'ordinateur ou à l'étudiant travaillant seul ou par petit groupe. Lorsque le contrôle est laissé à l'étudiant, il apprend au moyen d'un enseignement tutoriel, de démonstrations, de simulations ou de résolution de problèmes. La gestion des apprentissages se fait dans certains cas par ordinateur. Enfin, le résultat de mises à l'essai de matériel nouvellement développé complète le tableau. De cette dernière catégorie, il est difficile de retirer une information pertinente car très diversifiée et très peu explicite. Généralement, l'auteur porte davantage intérêt aux étapes du développement qu'aux résu Itats de la mise à l'essai elle-même, laquelle est souvent faite avec très peu de sujets.

Déficiences apparentes des publications scientifiques

II faut constater qu'un grand nombre d'informations, pourtant fort utiles à la compréhension des résultats de recherches, sont souvent inexistantes dans les publications scientifiques. Des carences se retrouvent dans la description de

l'enseignement lui-même, notamment la typologie des objectifs pédagogiques poursuivis. D'importantes lacunes se rapportent également à la description des sujets ayant participé à l'expérimentation, du vidéodisque (ou à défaut, son titre), de son interactivité, de son application et du temps consacré à l'expérimentation. Les écrits ne sont pas très explicites quant à la durée de l'enseignement. Certains rapportent un temps moyen, d'autres un temps maximum et minimum ou n'en font tout simplement pas mention. Dans les études répertoriées et conservées aux fins de cette recension, cette durée varie de 30 minutes à 600 minutes quoiqu'un grand nombre se situent entre 120 et 240 minutes.

Le regroupement des données selon l'évaluation au prétest post-test, au post-test ou selon le plan expérimental factoriel ou la mise à l'essai de matériel nouvellement développé fournit quelques indications qui semblent utiles. L'analyse des données s'oriente donc en ce sens.

Prétest-post-test

II s'agit d'une comparaison des données d'un ou de plusieurs groupes expérimentaux avec celles d'un groupe de contrôle. Les auteurs nous renseignent peu sur la durée de l'enseignement et le genre d'application du vidéodisque. Les différents domaines de la médecine et des sciences constituent le plus souvent le terrain d'expérimentation. Le Tableau 1 montre qu'il est difficile d'obtenir des résultats significatifs au niveau de la performance, à moins d'étudier un grand nombre de cas ou de comparer un enseignement avec des lectures. Par exemple, les 135 sujets de Ziegler (1991) connaissent mieux les services d'une bibliothèque lorsqu'ils peuvent contrôler l'enseignement donné au moyen du vidéodisque couplé à l'ordinateur.

Quelques recherches portent sur le temps d'apprentissage et sur les attitudes ou la satisfaction retirée par les étudiants en rapport avec l'enseignement reçu. Elles rapportent des différences significatives avec relativement moins de sujets.

Ziegler (1991) ne peut attribuer les différentes performances à l'expérience ou aux préférences individuelles des sujets. Il est intéressant de noter l'intérêt de Wankel (1985) envers les caractéristiques des étudiants. Il est cependant difficile de se fier à ses résultats étant donné le nombre restreint de sujets dans son étude.

Post-test

D'après le Tableau 2, on peut constater que plusieurs chercheurs se servent d'une mesure au post-test seulement lorsqu'ils disposent d'un nombre restreint de sujets ou inférieur à 100. Contrairement à la situation présentée au Tableau 1, les auteurs rapportent davantage d'informations concernant l'enseignement. Par exemple, la durée de l'enseignement varie de 66 minutes à 360. Les objectifs évalués sont habituellement de l'ordre de la connaissance, de la compréhension et de l'application. Quelques-uns s'intéressent aux activités psycho-motrices. Encore une fois, le champ d'intérêt se trouve surtout dans les domaines de la santé (Barker, 1988; Billings & Cobb, 1992; Fawver, Branch, Trentham, Hobertson & Beckett, 1990;Garrett&Savage, 1990; Guy &Frisby, 1992;Lyness, 1987;Tabar, 1991; Wilkinson, 1992), des sciences (Bunderson, 1981; Bunderson, Lipson, &

TABLEAU 1
Prétest, post-test

Aateuris)	Inter-activité	Doiaice ou utière	H	fla-sard	Groupes	Coaparaisons	RÉSULTATS Perfornance	Teips	Attitudes	Antécédents
O'Heil (1990)	III	para-iédical	34	non	E=V C=trad.	E/C n . s ,				
Hankel (19851	II	labo physique	36	oui	E=V C=Ubo	E/C n.s. niveau/style pré/post-tests seie/âge pré/post-tests avec/sans eip. pré/post-tests				niveau/style connitif n.s. d.s.post seie/âge n.s. d.s.post eipérienœ en physique d.s. avec d.s. avec
Hilhnson (19921	III	ïédecine	39	?	E=V C=problèies	E/C d . s . E B (attitudes/ styles cognitifsl n.s.				
Bunderson et al. 1198»)	III	biologie	49	vol.	E=V C=lect.	E/C post-test d.s.E 8/C rétention n.s. E/C pré/post d.s.E E/C pré/rétention d.s.B		8-		
Stevens 11985)	III	labo physique	49	?	E=V C=labo	E/C n . s . g . s .				

S = groupe eipéruental ? = vidéodisque d.s. = différence significative ! = résuié co = contrôlé par l'ordinateur
C = groupe de contrôle trad. = traditionnel n.s. = différence non significative PB = feed-back ce ; contrôlé par l'étudiant

TABLEAU 1 (suite)

n Gityoïf pL/ot-ttroi

Auteur(s)	Inter-activité	Doiaine ou natière	N	Ha-sard	Groupes	Coiparaisons	RÉSULTATS Perfonance	Teros	Attitudes	Antécédents
Vitale *i* Ronance (1992)	II	fonation des ïaîtres	14	?	B=V groupe C=trad.	B/C	d.s.E		idtiize. d.s.E processus n.s.	
Cockayne (19911	III	biologie	76	?	E^Vindividnel B_2=V groupe 2-3 B^=V groupe 4-5	*I^ll^V]* 8^83	'''S.	d.s^ $d.s.E_1$		
Soled et al. (1989)	?	para-iédical	83	oui	E=V*lect C=trad.»lect.	E/C	n.s.		d.s.E	
Schare et al. (1991)	III	para-»édical	83	oui	E=V*lect. C=trad.tlect. tdiapo	E/C	n.s,		d.s.E	
Jones S Schoultz (1990)	III	lédecine	135	tous	V	pré/post	d.s. post		satisfaction	
ïiegler (1991)	III	utilisation bibliothèque	135	oui	Ej=V ce 82=V linéaire C=visite guidée	Ej^/C • &2/C	d.s.Ej	d.a.E^ d.s.C	n.s.	eip. à l'ordinateur préférence ord. n.s.

TABLEAU 2
Post-test

Auteur(s)	Inter-activité	Doiaine ou Matière	H	Ha-sard	Groupes	Coiparaisons	RÉSULTATS Performance	Temps	Attitudes	Antécédents
Garrett î Savage (1990)	III	nédecine	32	oui	E=V C=lecttdiapo	E/C	a.s,		d.s.C	
Pollard (19911	?	traiteient de teites (couerce)	34	oui	E=V C=trad,	E/C perfonatce/ teips	n.s.	a.s. d.s.E	n.s. satisfaction	
Barris (1992)	III	fornation des «aîtres (cours de biologie)	35	oui	Ej=V»()tP8 82=Vtécrire+8 E3=ï*écrire*RtFB	E^Ei/E^	n.s.			stratégies d'appr,
						E2/E^	n.s.			66% rappel
						$E_1/E_2/B_3$	nb iota dans R	d.s.E!		
						E2/E}	n.s.			
Hilkinson (1992)	III	lédecine	39	?	E=V C=problèues	E/C	n.s.			
Slike et al. (1989)	?	langage par signes	40	oui	E=V C=trad.	E/C	n.s. d.s.B			
Barker (1988)	III	para-nédical	45	oui	E=V C=lect»déio	E/C post-test	n.s.			
						E/C application	n.s.			
BilUngs S Cobb (1992)	III	para-iédical	47	vol.	E=V*lect*unité C=trad.*lectt unité					style coanitif
						E/C			n.s.	pré-attitudes
						8/C				d.s. confort

CD

TABLEAU 2 (suite)
Post-test

Auteur(s)	Inter-activité	Doiaine ou natière	H	Ha-sard	Groupes	Couparaisons	BÉSDITATS Perfonance	Te»ps	Attitudes	Antécédents
Jones[2] (1988)	III	labo chine	48	?	E=V C=labo	B/C	d.s.B	d.s.E		
Jones (1988)	III	labo chiite	52	oui	B-·Ï C=labo	E/C	d.s.E	d.s.E		
Hiett S Case? (1989)	III	physique	52	oui	B=V C=?	E/C	d.s.E			aptitudes n.s.
Carlson S Palk (1989)	III	foriation des laîtres	66	oui	E_I --V indnctif E_2 =V dédactif C=trad.	Ej/Ej/C E_2/C E_1/E_2/C BJ/E2/C EjE_2/C Ej/C	d.s.E] concepts d.s.B_2 d.s.Ej habiletés d'observation d.3.E[habiletés d'enseigneient n.s.	d.s.E^ n.s. habiletés de pensée	n-s. design d.s.E_1E_2 tech.	
Kil i ïounq 11991)	III	foriation des laîtres	71	oui	8j=ïens.*Q E_2=Vens.»fi B_3=Vens.»i3»a	Ej/E_2/EyB^	pjw^ijujes_ d.s.EiE$_7$Ei 1 2 3			perception de son efficacité d.s.E_2E_3

[2] Joues (198S) procède à des espéritentationa doit le noibre de sujets diffère.

TABLEAU 2 (suite)
Post-test

Meur(s)	Inter-activité	Doiaine ou natière	N	Ha-sard	Groupes	Coiparaisons	RÉSULTATS Perfonance	Tems	Attitudes	Antécédents
Tabar 11991)	III	para-uédical	75	oui	E=V C=lect.	B/C GPA/test	n.s. n.s.			
Fanver et al. (19901	III	lédecine vêt.	85	oui	E=V groupe 3-4 C=labo groupe 3-4	E/C	cardiovaacuiaire B.S. fibrilUtion n.s.	d.s.E - d.s.C -		
Joues (1988)	III	labo chine	91	?	E=V C=hbo	E/C	d.s.E			
tyness (1987)	III	para-iédical	99	oui	E=ï C=trad.	E/C	n.s. "Heartsaver" d.s.E 'Obstructed[1] n.s, 'Infant' n.s. connaissances			
Harvel (1990)	I	foliation des «aîtres dicto-enseigneient)	112	tous	E=ï * eieiples C=observation lodèle réel	E/C	n.s. anticipatory set d.s.E objectifs d'enseigneient n.s. vérifier coipréhension d.s.B fin de leçon			
Bunderson (1981), Bunderson et al. (1984)	III	biologie	150	?	E=V Mrad.	E/C	d.s.E B-			
Guy i Prisby (1992)	III	para-iédical	252	oui	E=V C=labo	E/C	D.3.			

Fisher, 1984; Hiett & Casey, 1989; Jones, 1988) et de la formation des maîtres (Carlson & Falk, 1989; Harris, 1992; Kim & Young, 1991; Marvel, 1990). Une variété d'applications du vidéodisque interactif se retrouvent ici. Elles passent de l'enseignement tutoriel à la démonstration, aux simulations, aux jeux, aux jeux simulés, à la résolution de problèmes et quelquefois à la gestion des apprentissages. Les recherches effectuées à l'aide du post-test comparent généralement l'enseignement donné au groupe expérimental avec celui traditionnel donné au groupe de contrôle.

À la lecture du Tableau 2, il faut constater la diversité des résultats obtenus à tous les niveaux. Est-ce le fait de la qualité de la conception pédagogique de l'enseignement décerné par les vidéodisques, de la variété des applications à l'enseignement ou du nombre trop restreint de sujets ayant participé à ces études? Les auteurs sont peu explicites quant aux deux premières parties de cette question. Cependant, le nombre limité de sujets impliqués dans quelques-unes de ces recherches constitue probablement une importante faiblesse.

Plan expérimental factoriel

Les domaines de la biologie, de la psychologie, de la formation des maîtres, de l'apprentissage d'une langue seconde, des arts et de l'astronomie utilisent ce devis de recherche. Il faut noter ici dans la plupart des cas, un enseignement de très courte durée (45 minutes ou moins) avec un nombre de sujets souvent restreint, compte tenu des nombreux sous-groupes impliqués. Les objectifs poursuivis par l'enseignement sont de l'ordre de la connaissance, de la compréhension, de l'application et des habiletés motrices.

Les recherches qui utilisent ce plan expérimental analysent simultanément 2 ou 3 facteurs. Le Tableau 3 montre l'intérêt des chercheurs envers les modes de présentation de l'enseignement ou d'évaluation des apprentissages (Baggett, 1988; Chou, 1991; Hannafin, Phillips & Trip, 1986 ; Smith, 1988; Walkley, 1986; Walkley & Kelly, 1989), les stratégies d'enseignement (Carlson & Falk, 1990-1991; Hannafin et al., 1986; Shen, 1992), le contrôle de l'apprentissage (Burwell, 1991) ainsi que la moyenne en lecture, les habiletés et les types de formation.

Carlson & Falk (1990-1991) étudient la méthode d'enseignement-apprentissage déductive/inductive avec l'enseignement individuel ou par groupe de deux avec un enseignement assisté par vidéodisque ou traditionnel. Hannafin et al. (1986) examinent les effets "d'acivités d'orientation", du traitement et d'exercices pratiques sur l'apprentissage. Milheim (1990) s'intéresse pour sa part au contrôle de l'apprentissage par l'ordinateur (CO) ou par l'étudiant (CE) par l'intermédiaire des facteurs de rythme d'apprentissage et de séquences d'enseignement. DemêmeBurwell(1991)étudieleCOetleCEjumelésauxstyles cognitifs dépendant et indépendant du champ. Shen (1992) choisit des sujets dont les habiletés de lecture dans une langue seconde sont opposées. Il leur offre un traitement avec ou sans sous-titres (non traduits) de la conversation reproduite par le vidéodisque. L'étude de Baggett (1988) porte sur l'habileté des sujets à assembler les 80 pièces d'un objet. Les principales comparaisons étant l'assemblage en même temps que l'enseignement (en ligne) ou par la suite, soit

TABLEAU 3

Plan expérimental factoriel

Auteur(s)	Inter-activité	Doiame ou «atière	H	Ha-sard	Groupes	Coiparaisons	RÉSDITSTS Perfornance	Te»os	Attitudes	Antécédents
Halkley (19861, Kalkley et al. (19891	III	fornation des «aîtres d'éduc. physique	54		Ej=V ind. Ci=trad.*vidéo C^vidéo ind.	E l c l Ws	prétest/post-test n.s. 'lancer[1] n.s. 'attraper[1] post-test 'lancer[1]			
					foraation P^maîtres en eiercice	E l"-l'c2 Ej/C^	d.s.E^Cj n.s. post-test 'attraper'			
					Pjïforiiation initiale habiletés lancer attraper	Ej/C_1/C_2 Ci/Ci	d.s.E, d.s.Cj			
Baggett[3] (1988)	III	psychologie (assemblage de pièces)	64	?	5i=V en ligne E^V de léioire Bj/C délai de 7 ïours		notions de structures et de fonctions n.s.			
					E^=V en ligne E^=V de »ê«oire C=vidéo passif	E^/Ej		d.s.E_5		
Carlsot (Palk (1990-1991)	III	foriation des uîtres	66	oui	Bl--Ï inductif/1 E_7=V inductif/2 E,=ï déductif/1 Sl=V déducti£/2 C^trad./l C2=trad./2 Bj à 84/0^2	EjEj/C.Cj E^Ej/CjC, E,E_2/E,E_4 E 3'4C2 d.a.B^jBjB,	concepts d.s.EjE, d.s.E^ n.s. n.s. habiletés d'observation			

Baggett (1988) procède à **des eipérinentations dont le** no«bre de sujets diffère.

TABLEAU 3 (suite)
Plan expérimental factoriel

Anteurlsl	Inter-activité	Doiaine ou latière	»	Ha-sard	Groupes	Couparaisons	RÉSULTATS Perfonance	Teups	Attitudes	Antécédents
Carlson k Falk (1990-19911 (suite)						EiE$_7$/EiE« Ei/Cj 8,/C, Ej à E,/CjC$_2$	n.s. r,.s. d.s.Ei	d.s.E$_3$	satisfaction d.s.EiE^	
Shen (1992)	III	langue seconde •	72	oui	sous-titres		post-test; (il«			
					É«=V avec	*Ifyll-,!,*	n.s.			
					E$_2$=V sans	E?/Ë$_2$	d.s.E,			
					Moyenne en lecture	Fj/F^				d.s.F,
							post-test: TOEFl			
					F$_3$= au dessus	^{E}lM^{F}3^{F}4	n.s.			
					F«= au dessous	E</Eo	n.s.			
						^{P}3/^{P}4				d.s.F$_3$
Baggett (19K8)	III	psychologie lasseiblage de pièces)	76	?	E,=V de léioire Ej=V en ligne écran noir	E,/E$_2$	notions de structures et dfe fonctions			se.je d.s. garçons
							n.s.			
Hannafin, Phillips S Trip (1986)	III	arts	80	oui	eiercice; pratiques					
					Ej=V avec E$_2$=V sans teips d'accès	Ej/Ej	d.s.E, (faits) n.s. (application)			
					E,=V 5' Ejj'ï 20' activités d'orientation	E,/E,	d.s.Ej (avec act.) d.s.EQ (sans act.)			
					E$_5$=V avec E$_r$; V sans	E$_5$E$_6$/E$_3$E$_4$/E$_1$E2	interaction			

TABLEAU 3 (suite)
Plan expérimental factoriel

Auteur(s)	Inter-activité	Doiaine ou aatière	H	Ha-sard	Groupes	Conparaisons	RÉSULTATS Perfortance	Teips	Attitudes	Antécédents
Burnell (1991) •	III	astronome	37	oui	contrôle					
					E^ïco	85/84				a.s.
					B_2=Vcé	EjE$_2$/C	d.s.B$_1$E2			
					style coqnitif					
					E^indépendant	EjE^/BjEj	interactioo	B^t		
					E^dépendant					
					Oteite					
Baggett (1988)	III	psychologie (asseiblage de pièces)	96	?	E^V en ligne		notions de structures et de fonctions			
					E2=ï de «éioire	ïi/Ej			d.s.E,	
					C=vidéo passif	E^/C Ei			d.s.E^	
						Ej/C			o.s.	
Hilheii (1990)	III	photographie	99	vol.	Contrôle par		post-test médiat			
					l'étudiant	Ej/E^/Ej/E^	d.s.Ej			
					Ej=ï rythie	*Ifyl^^*	n.s.			
					lj=^ séquence		post-test à long terne			
					contrôle par	Ej/E2/E2/B^	d.s.E$_1$			
					l'ordinateur	EtEiMi	n.s.			
					E$_3$=V rythie		post-tests médiat et à long terie			
					E«=V séquence	Bi/B^/Bi/E»		d.s.E,		

TABLEAU 3 (suite)
Plan expérimental factoriel

Auteur(s)	Inter-activité	Doiaine ou latière	H	Ha-sard	Groupes	Coiparaisons	RÉSETATS Perforïance	Teips	Attitudes	Antécédents
Siith (1988)	III	biologie	115	oui	te«ps de pause		post-test			
					E,=V .*!'	Ej/E_2	d.s.E,	n.s.		
					82=" 40'	$^{F}3/^{F}4/^{F}5$	n.s.	d.s.F_5		
					pause après ...	EjEj/P-jF^	n.s.	n.s.		
					P_3=objectifs	EjE^Ypj/C				
					Pi=contenu				n.s.	
					Fr=soiuaire				convivial	
					C=V				n.s.	
									rythie	
									n.s.	
									org. du contenu	
									n.s.	
									connaissance du contenu	
									n.s.	
									densité du contenu	
									n.s.	
Chou (1991)	?	foriation des Mitres léduc. physique)	135	oui	présentation		iode de présentation		graphiques	
					E^ord.	Ej^/E^	n.s.	n.s.		
					E_2=V				vidéo	
					E^ord.tvidéo				n.s.	
					E^=V*ord.	EjEjB^B^F^g	interaction		n.s.	
							•ode d'évaluation		graphiques	
					P_5=Vord.	EJ/E2/F.3/E4	n.s.		n.s.	
					Pjj=ïvidéo				vidéo	
									d.s.P_6	
									oraphiques * vidéo	
						I_3/E,			n.s	

immédiatement après ou dans un délai de 7 jours (de mémoire). Le vidéodisque ou le vidéo servent alors de moyen d'enseignement. Walkley (1986, 1989) compare l'acquisition d'habiletés à la formation des maîtres en exercice et à la formation initiale lorsque les traitements sont fournis au moyen du vidéodisque, de l'enseignement traditionnel ou simplement par un vidéo. Smith (1988) s'intéresse à la durée et à l'emplacement de pauses dans l'enseignement. Finalement, Chou (1991) compare l'ordinateur et le vidéodisque comme mode de présentation et d'évaluation dans des activités de discrimination.

Tous ces facteurs représentent un très grand intérêt en technologie éducationelle puisqu'ils portent principalement sur les différences individuelles des étudiants et sur la conception pédagogique de l'enseignement. Ce devis et le choix judicieux des facteurs semblent prometteurs quant à l'étude de l'interaction des causes et des effets. Cependant, le petit nombre de sujets ayant participé à quelques-unes de ces recherches ($N < 100$), subdivisé en plusieurs sous-groupes semble la faiblesse principale de l'application qui est faite ici de ce devis. Il s'avère essentiel de corroborer les résultats obtenus avec d'autres recherches impliquant un plus grand nombre de sujets. Il est intéressant de noter dans l'étude d'Hannafin et al. (1986) l'interaction au niveau de la performance, des facteurs "activités d'orientation", "accessibilité à des exercices pratiques" et "temps d'accès" différentà l'information. Burwell(1991)obtientaussi une interaction des facteurs reliés au degré de contrôle de l'apprentissage offert et au style cognitif de l'étudiant.

Mise à l'essai

Les mises à l'essai de vidéodisques se font souvent avec très peu d'étudiants. Le Tableau 4 présente seulement celles qui répondent aux critères de cette recension. La représentation des domaines de la santé et des sciences demeure importante avec un nombre de sujets variant de 103 à 689. Différentes applications du vidéodisque viennent souvent remplacer le laboratoire traditionnel. Les chercheurs comparent une ou deux versions expérimentales du vidéodisque avec l'enseignement ou le matériel traditionnel. D'autres s'intéressent seulement aux versions expérimentales. La durée de l'enseignement s'échelonne de 25 à 600 minutes. Les habiletés évaluées sont de l'ordre de la connaissance, de la compréhension, mais aussi de l'observation et de l'analyse en plus d'habiletés manuelles.

Une mise à l'essai se veut une validation du matériel d'enseignement à la fin de l'étape du développement. Une évaluation sommative vérifie alors le degré d'atteinte des objectifs poursuivis de même que la valeur de ce produit par rapport au matériel ou au cours qu'il remplace. D'autres effets non anticipés peuvent aussi être observés. La procédure consiste le plus souvent à comparer de façon quantitative ou qualitative le nouveau produit avec l'enseignement traditionnel. Il est difficile de généraliser à partir des informations provenant de ces mises à 1 essai. Elles servent surtout à la prise de décision par rapport à ce produit spécifique. Les leçons apprises pendant les différentes étapes d'un développement contribuent aussi à l'amélioration des connaissances dans ce domaine.

TABLEAU 4
Mise à l'essai

Auteur(s)	Inter-activité	Doiaine ou latière	11	Ha-sard	Groupes	Coiparaisons	RÉSULTATS Perronance	Teios	Attitudes	Antécédents
Shyu S Broun (19921	III	psycholo9ie	52	oui	Ej=Vco B2=Vcé»sug- ijAstinna	 Ej/E2	tâche ^s.Bi pré-efficacité	&.s.l\		
						8^/82	"'S- post-efficacité		!>•••	
						Ej/B2	n.s.			
Slith, Jonea S Haugh 11980	?	labo chiiie	103	oai	Ej=V E2=V*labo C=lâbo	 6^/82 E^C	eiauen oral n.s. d.s.E_1			
						E_2/C	d.s.E_2			
Gastkeiper (1984)	III	?	120	oui	contrôle par ord.		connaissances			
					Ej=V groupe/2 E^=ï grnupp/J	8^2	d.s. coiparaison léioire à court tene n.s.			
Jensh (1987)	?	lédecine	128	vol.	V				satisfaction	
Blackian, Albanese, S fluntley (1985) Huntley, Blackaan Aibanese l tongh (1985)	TIT	«édsciiKi	135	'	B=V C=trad,	E/C	connaissances d.s.E d.s.E		satisfaction	eipérience clinique n.s.

TABLEAU 4 (suite)
Mise à l'essai

Auteur(s)	Inter-activité	Doiaine ou lâtière	«	Ha-sard	Groupes	Coiparaisons	RÉSULTATS			
							Perfonance	Teiips	Attitudes	Antécédents
Russell 4 al. (1985)		labo chine	326	?	E=ïcé C=vidéo	E/C	d.s.E écrit d.s.E précision de t.s. analyse graphique			
Davis (1984,1985)	III	labo sciences	689	hasard ou vol. ou 00)19,	E=Vcé	l/univ./ïtitre			'Respiration' d.s. Nebraska Univ. 'Chute i Life' d.s. Nebraska Univ. n.s. 'Cheiicai' n.s. 'Studies in Motion' n.s. 'Enerav Transfonation' n.s.	

Mentionnons que Davis (1984, 1985) compare des attitudes d'étudiants provenant de sept Universités américaines avec l'enseignement reçu avec différents vidéodisques offrant le contrôle de l'apprentissage. Certains problèmes d'expérimentation viennent compliquer l'analyse des résultats.

CONCLUSION ET RECOMMANDATIONS

La majorité des études de cette recension portent sur la mesuré de l'efficacité du vidéodisque dans l'enseignement comparée le plus souvent à l'enseignement traditionnel. Les variables dépendantes concernent la performance des étudiants, le temps consacré à la tâche, leurs attitudes. D'autres se questionnent à propos de l'influence sur l'apprentissage des différences individuelles des étudiants ou des caractéristiques pédagogiques de l'enseignement. C'est le cas de Wankel (1985) qui est la première à s'intéresser aux caractéristiques des étudiants. Plus tard, d'autres vérifient l'effet sur l'apprentissage des connaissances préalables, de l'expérience, des aptitudes et du sexe. L'enseignement individualisé ou par petit groupe, l'interactivité pédagogique au moyen du style et des méthodes d'enseignement, du contrôle de l'apprentissage de même que l'interactivité technique sont tous des sujets recensés dans cette publication.

De cet éventail de recherches faites auprès d'étudiants de niveau universitaire, il est heureux de constater que l'intérêt s'amorce graduellement envers les variables reliées aux caractéristiques de l'enseignement et de l'étudiant. Cette orientation semble prometteuse pour une meilleure compréhension de l'interaction de ces diverses caractéristiques. À ce sujet, quelques typologies existantes peuvent servir de base aux études. Pensons plus spécialement à celles se rapportant à l'apprentissage, aux différences individuelles, aux médias, à l'interactivité, aux applications des médias, etc. Deux recommandations complètent cette réflexion.

Recommandation 1

La première recommandation concerne les recherches subséquentes. Elles devraient porter sur l'identification des caractéristiques techniques et pédagogiques de l'enseignement, jumelées à celles de l'étudiant afin d'en vérifier l'interaction dans l'apprentissage. La compréhension de cette interaction permettrait enfin de clore le débat depuis longtemps amorcé sur le rôle des médias dans l'apprentissage. Plus encore, les technologues en éducation seraient ainsi en mesure d'appliquer ces nouvelles informations à la création de designs pédagogiques mieux adaptés à la technologie utilisée, à la situation en même temps qu'à l'étudiant.

Afin d'ajouter davantage de clarté aux résultats de toutes ces recherches, il importe de les communiquer de façon claire et précise. En rapport avec cette difficulté, Tuckman (1990) propose diverses façons d'améliorer la qualité des écrits en éducation. Les déficiences des études publiées dans le domaine de

l'enseignement assisté par vidéodisque relèvent surtout de la méthodologie et de la communication. Malgré l'élagage effectué parmi les études compilées aux fins de cette recension, certaines limites persistent. Elles peuvent se résumer en trois points. Il s'agit de la définition des termes et de leur description, du nombre de sujets et de l'application du hasard.

Limite 1

Certains termes sont rarement bien définis dans les écrits de recherches. Le premierestceluide l'apprentissage. De quel apprentissage s'agit-il? Quellessont les habiletés, ou plus précisément, quels sont les objectifs pédagogiques évalués par cet enseignement ?

Le terme "enseignement" mérite davantage d'explications. Quelle est sa durée? Qu'est-ce qui caractérise son contenu, le matériel d'apprentissage, son design y compris ses stratégies et son interactivité pédagogique ?

Un autre terme à compléter se rapporte au vidéodisque lui-même. Quel est son niveau d'interactivité technique (niveaux 1,2,3)? De quel type d'application s'agit-il (tutoriel, démonstration, jeu, simulation, résolution de problèmes, banque de données,...)?

Finalement, qui est l'étudiant? Quelles sont ses caractéristiques? l)ansquel milieu environnemental et démographique peut-on le situer ?

L'absence de ces informations fait en sorte qu'il est impossible d'associer les éléments d'une typologie d'interactivité technique du vidéodisque ou de son application avec certaines caractéristiques des étudiants ou du design de l'enseignement.

Limite 2

Plusieurs études n'apparaissent pas dans cette recension à cause du nombre très limité de sujets y ayant participé. Celles retenues arbitrairement (N > 30) n'assurent pas nécessairement un niveau de confiance suffisant. La généralisation des résultats s'en trouve d'autant diminuée.

Limite 3

De façon générale, les recherches en éducation font peu appel au hasard pour le choix de l'ensemble des sujets. Cette recension ne fait pas exception puisque le hasard, lorsqu'il est mentionné, se concrétise au moment de la formation des groupes. Quatre chercheurs font plutôt appel à des volontaires (Billings & Cobb, 1992; Bunderson et al., 1984; Jensh, 1987; Milheim, 1990), d'autres à tous les étudiants disponibles dans un secteur, une faculté ou un cours (Jones & Schoultz, 1990;Marvel, 1990). Davis(1984, 1985) utilise un amalgame de volontaires, de sujets choisis au hasard et de cours obligatoires alors que O'Neil (1990) ne se préoccupe pas du hasard.

La constatation de ces déficiences des publications scientifiques dans la description de l'apprentissage, de l'enseignement, du vidéodisque, de l'étudiant et de la méthodologie de recherche amène le problème suivant. Le lecteur connaît le résultat de l'apprentissage. Mais il ne sait pas toujours comment l'auteur en

est arrivé là ni ce qui est évalué (l'objet de l'évaluation) ou avec quel enseignement l'étudiant interagit avant de produire ce résultat.

La difficulté d'évaluation des recherches provient de ces limites. Il faut constater aussi qu'elles sont un obstacle à la généralisation et surtout à la construction d'une théorie des médias dans l'enseignement, plus spécialement du vidéodisque.

Recommandation 2

Les nombreuses études portant uniquement sur la comparaison de deux méthodes ou deux médias d'enseignement s'avèrent peu utiles à la compréhension du rôle de l'enseignement médiatisé dans l'apprentissage. Les limites mentionnées plus haut amènent une deuxième et dernière recommandation. Il nous faut connaître quelles caractéristiques de l'enseignement, de l'étudiant, du vidéodisque peuvent être associées afin de produire l'effet cognitif voulu. Les chercheurs devraient décrire davantage dans leurs écrits non seulement les sujets et l'objet de l'évaluation, mais aussi l'enseignement et la méthodologie. Cette information permettrait de déceler les effets cognitifs réels de ces caractéristiques et de leur interaction dans l'apprentissage.

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Analyses of the Instructional Motivation Needs of Adults

Roy M. Bohlin
William D. Milheim

Abstract: Previous studies support the ARCS model and were used to develop a Needs Assessment Instrument and the Adult Learner-Instruction Interaction Motivation Model, Each of these can be used to effectively plan for the motivational needs of adult learners. Specific strategies for addressing the needs of older learners are also provided.

Resume: Des etudes anterieures soutenant la validite du modele «ARCS» ont servi de base pour ('elaboration d'un instrument devaluation des besoins et d'un modeled'enselgnementtheoriqued'interactionetdemotivatlonpourl'apprenant adulte. Chacun de ces modeles peut tres bien etre utilise pour pourvoir aux besoins et 6: la motivation de l'apprenant adulte. Des strategies specif lques s'adressant aux besoins des etudiants plus 6ges sont egalement fournies.

INTRODUCTION

Historically a number of researchers (Aslanian & Brickel, 1980; Cross, 1981; Houle, 1961; Knowles, 1980; Zemke & Zemke, 1981) have suggested that adult learners have very specific motivational needs in instructional settings. Life experiences (Knowles, 1980), life transitions (Cross, 1981), or learned attitudes over time (Wlodkowski, 1985) have all been suggested as contributing to these somewhat different requirements. As a result, these authors recommend that instruction for adult learners be designed differently from other types of instruction. While well-designed instruction may be effective for most learners, adults usually are not socialized to the culture of the typical classroom. As such, motivation can be very different for these adults as compared to traditional, younger students.

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MOTIVATIONAL INSTRUCTIONAL DESIGN

Instructional motivation attracts learners to the instruction and increases their effort in relation to the subject (Keller, 1983). Instructional motivation, by this definition, has two main components: it is interesting and effort generating. This type of instruction, therefore, has appeal or interest for the learner and stimulates learner effort. This dual characteristic of instructional motivation has been supported in previous studies (Bohlin, Milheim, & Viechnicki, 1990a & b).

Keller (1987), Keller and Kopp (1987), and Keller and Suzuki (1988) identify four categories of motivational strategies in learning situations: Attention, Ttelevance, Confidence, and Satisfaction (ARCS). To facilitate continuing motivation, strategies in these four categories should be addressed. While the instructor typically cannot control the learners' characteristics (such as expectancy for success), the instructor usually has control over the methods or strategies of instruction, which in turn produce various instructional consequences. The consequences, resulting from the interaction of the methods with the learner's characteristics, are termed "outcomes." The ARCS model, therefore, contains specific methods or *strategies,* that are aimed at producing motivational outcomes, when learners are experiencing specific *conditions,* such as interest or motives.

The initial requirement for motivating instruction is to gain and maintain the *attention* of the learner. This can be achieved through procedures that increase curiosity, interest, or by using techniques such as arousal through humor, variety, or enthusiasm. Second, the instruction must have a perceived *relevance* to the personal needs of the learner. These personal needs can be met by matching the instruction to learners' goals, making the benefits clear, and keeping the challenge level appropriate. Next the instruction must provide for the confidence of the learner. This relates to the learner's expectancy for success or failure, which influences the actual effort and performance, and can be increased by strategies such as clearly indicating the requirements for success, providing a low risk environment, and giving accurate attributional feedback. Lastly, the instruction should promote individual *satisfaction* in order to facilitate continuing motivation. Learners must perceive the rewards gained as appropriate and consistent with their expectations. Learner satisfaction can be promoted by providing appropriate recognition for success, giving informative and corrective feedback, and other similar strategies.

Although the literature is abundant with suggestions about the needs of adult learners, there appears to be little aimed at the design of instruction that meets the motivational needs of adults. While the ARCS model is intended for all types of learners, the data to support it were originally collected in K-12 classrooms. This potential limitation of the ARCS model, is met by the Course Effort Survey Revised (CESR) and the Adult Learner-Instruction Interaction Motivation Model. These can help designers of adult instruction and materials to create more motivating products.

NEEDS ASSESSMENT INSTRUMENT

The needs assessment instrument was developed through a series of revisions (Bohlin, Milheim, & Viechnicki, 1990a; Bohlin, Milheim, & Viechnicki, 1990b; and Viechnicki, Bohlin, & Milheim, 1990) of an original instrument developed by Keller and Subhiyah (1987) to evaluate the degree of motivation effects of instructional materials. After rewording or deleting those items not consistent with the evaluation of classroom instruction, several items were added which were identified in the literature as important to the instructional motivation of older learners.

The final product, the CESR, has been used to assess the instructional needs of generalized adult populations (Bohlin, Milheim, & Viechnicki, 1990b; Bohlin, Milheim, & Viechnicki, 1993b; and Viechnicki, Bohlin, & Milheim, 1990). The purpose of this instrument is to identify the instructional motivation needs of learners. As such it is not intended to be a psychometric instrument, rather it is simply a needs-assessment tool. The CESR is composed of 42 items, which are a selection of strategies which have been identified in the literature as having motivational effects on various learners (See Table 1).

The instrument can be used to determine the motivational needs of specific individuals or of specific groups. It can also be used to measure the needs of a representative group of a population with the intent of obtaining generalizable prescriptions for that population. This information can then be used as a framework for planning and designing instructional strategies for motivating that adult population.

ADULTS' GENERAL MOTIVATIONAL NEEDS

Analysis of the items ranked highest by the adults from a variety of instructional settings have shown especially important motivational strategies (Bohlin, Milheim, & Viechnicki, 1993b). While some were specific to improved interest or to improved effort, others were rated important to both. A listing of the highly rated items follows, with the letter and number identifying the subscale and item number from Table 1.

Strategies rated very important specifically to *interest:*

A2 Content captures my attention
A3 Makes the subject matter seem important
R2 Allows time for practical application of the content
CIO Instructor models and demonstrates proper skills during instruction

Strategies rated very important specifically to *effort:*

C4 Whether or not I succeed is up to me
S2 Can set and achieve high standards of excellence
S4 Instructor's evaluations of my work match how well I think I have done

Table 1

Content of Items in the Course Effort Survey (CES) by Subscale

Attention

1 Makes me feel enthusiastic about subject
2 Content captures my attention
3 Makes the subject matter seem important
4 Shows how the content relates to things I already know
5 Uses humor during instruction
6 Makes me feel curious about the subject matter
7 Does unusual or surprising things that are interesting
8 Uses an interesting variety of teaching techniques
9 Curiosity is often stimulated by the questions asked or the problems given

Relevance

1 Information I learn will be useful to me
2 Allows time for practical application of the content
3 Benefit from the knowledge acquired in the class
4 Actively participate in the class
5 Positive role models be presented to me in class
6 Is flexible to meet my needs in content and assignments
7 Personal benefits of the course are made clear to me
8 Challenge level is about right
9 Have some input or choice in content and assignments
10 Get a chance to work with other people in the class
11 Content relates to my expectations and goals
12 Personally benefit from what I learn in the class

Confidence

1 Helps me feel confident that I can do well
2 Makes me feel I have the ability to succeed
3 Builds my self-esteem
4 Whether or not I succeed is up to me
5 Creates a relaxed classroom atmosphere
6 Requirements for success are made clear to me
7 Frequent opportunities to succeed
8 Helps me to believe I can succeed if I try hard enough
9 Get enough timely feedback to know how well I am doing
10 Instructor models and demonstrates proper skills during instruction
11 Non-threatening
12 Designed so that everyone can succeed

Satisfaction

1 Gives me a lot of satisfaction
2 Can set and achieve high standards of excellence
3 Fair recognition compared to other students
4 Instructor's evaluations of my work match how well I think I have done
5 Helps me to accomplish my own personal goals
6 Feel satisfied with how the class is run
7 Get enough recognition for my work through feedback
8 Amount of work I have to do is appropriate
9 Feel satisfied with what I learn

Strategies rated very important both to *interest* and *effort:*

- A1 Makes me feel enthusiastic about subject
- R1 * Information I learn will be useful to me
- R3 * Benefit from the knowledge acquired in the class
- R12 Personally benefit from what I learn in the class
- C6 * Requirements for success are made clear to me
- C7 Frequent opportunities to succeed
- C9 Get enough timely feedback to know how well I am doing
- 58 Amount of work I have to do is appropriate
- 59 Feel satisfied with what I learn

*The three highest-rated strategies

INTERACTION MOTIVATION MODEL

Results of factor analyses (Bohlin, Milheim, & Viechnicki, 1993a) provide additional support for the four categories of strategies proposed by the ARCS model — Confidence, Relevance, Attention, and Satisfaction, respectively. Further analysis of these results has produced a revised model of motivational adult learner-instruction interaction. This model provides the most important elements of the instructional environment, characteristics of the learners, and the resulting outcomes of their interaction (See Figure 1). While Keller does not use the ARCS categories to classify instructional outcomes, it does seem appropriate to use these category names for the consequences of the instruction-learner interaction. The strategies in the four categories are, in fact, aimed at maintaining the learners' attention, perceptions of relevance, expectancy for success, and satisfaction.

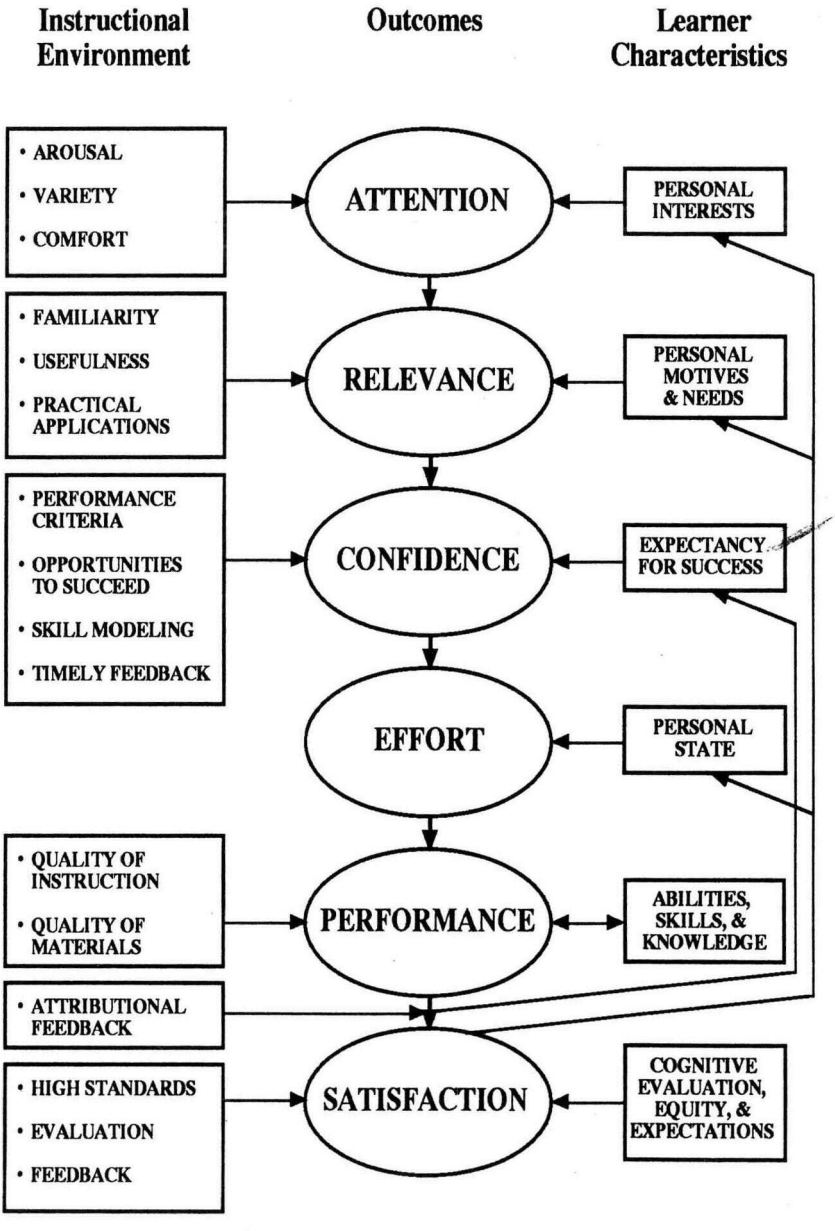
The Adult Learner-Instruction Interaction Motivation Model, therefore, uses the ARCS categories to classify the outcomes of the instruction. The model also represents the relationships among specific instructional strategies, learner conditions, and outcomes for adults. This model may provide a framework for research, theory and hypothesis building, and the development of instruction regarding adult learners.

EDUCATIONAL TECHNOLOGY APPLICATIONS

This model can be applied in a variety of ways. First, if possible the CESR should be used as a needs assessment instrument. This can best determine the specific needs of the target adult group. If it is not practical to administer it to a sample of your target group, then it would be best to use the following generalized prescriptions.

When designing instruction for adults in a content area or an environment that is not intrinsically appealing, the designer should follow these guidelines:

Figure 1.
Revised Adult Learner-Instruction Interaction Motivation Model



1. Design the surroundings, the instruction, and the assessment in ways that are non-threatening (e.g., add individualized materials and small cooperative groups to the instruction to help give the feeling of support and low risk). This will make the learning more comfortable.
2. Provide the learner with some control over instruction and assessment (e.g., allow the learners to prescribe.the size of the chunks of learning between tests, give the learners opportunities to apply the content in ways that are relevant to them). This will improve the confidence level, and degree of satisfaction.
3. Design the instruction so that the learners are regularly reminded that the content is challenging, but not so difficult to undermine confidence. This will raise the adults learners' satisfaction with their accomplishments.
4. Design the instruction so that it specifically demonstrates the usefulness of the learned content (e.g., showing applications in the real world, challenging the learners to find ways to apply the knowledge to their lives). Real world applications satisfy the relevance to the learners' needs.
5. Provide for ways that clearly describe the learning and clearly explain the requirements for successful completion of the unit (e.g., list the goals at the beginning, outline the topics and sequence to be covered, state specific levels of outcome performance and the percent of learners who accomplish it on their first try). This will also increase the learners' expectancy for personal success.
6. Design the instruction so that it builds on any naturally interesting aspects of the content (e.g., present mysteries or paradoxes in the subject area, use inquiry questions, use high-level open-ended questions where possible). This will increase learners' arousal and interest.

When designing instruction and materials for adults who may not give forth as much effort as desired, the designer should plan the instruction to follow some of these guidelines:

1. Design the instruction to improve the learners' confidence levels (e.g., start with easier problems and slowly increase task difficulty, slowly build the level of the inquiry questions). This will improve the learners' expectancy for success.
2. Provide feedback that links success to ability and effort (e.g., "See! You can do it when you work at it!" 'Yes, you know how to do it!"). If not overdone, this can provide for internal attribution which can raise the expectancy for success of the learner.
3. Provide feedback that helps the learner feel supported (e.g., "Let me try explaining this again, I know *we* can do better," assure the learner that they can try things as often as they need to hi order to learn the material).

This can make the learning environment more comfortable and increase persistence.

4. Design the instruction so that it connects to the learners' real-life situations (e.g., use examples in their everyday jobs, let them use applications in their personal lives). This helps to make the learning more relevant and the products more useful.

CONCLUSION

There are many ways that this model can be applied to the design of motivating instruction for adult learners. The designer should focus on the needs of the adult learner as outlined in the previous section, and creatively design interventions, feedback, screen designs, and program structures that make the learning more appealing and the learner more confident. Although this is motivational for most learners, these types of strategies are especially important to meet the needs and motives of adult students.

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A Proposed Model for the Systematic Design of Instructional Pictures

Faye Wiesenberg
David Baine

Abstract: This paper describes a systematic method for producing pictures to accompany textual Instructional materials. The method integrates Gagne's classic approach to textual Instructional design with Goldsmith's approach to evaluating educational illustrations, that is based on empirically validated principles of visual perception and communication. The resulting instructional design model describes a procedure for creating the textual, and pictorial elements of printed, Instructional materials used in an ATI study to produce Instructional materials that appeared to differentially affect the learning outcomes of adult learners with different levels of visual learning skills.

Resume: Get article decrlt une methode systematique de production d'lmages utllisees dans les documents textuels didactiques. Cette m6thode permet ('Integration de la methode de conception de documents textuels didactiques classiques de Gagne au precede devaluation des Illustrations didactiques de Goldsmith qui est basesur des principes de validation externe de perception visuelle et de communication. Le modele didactique qui en decoule presente un proced6 de creation d'e!6ments textuels etd'imagesde documents didactiques utilises dans une «6tude ATI* pour produire du materiel didactique qui semblalt affecter, par action differentiate, les resultats obtenus par les etudlants adultes de differents nlveaux d'apprentissage visuel.

INTRODUCTION

Educational researchers have confirmed that, in some circumstances, adding pictures to represent verbal information in printed instruction has resulted in better learning outcomes (Dwyer, 1978, 1987; Fleming & Levie, 1978; Levie & Lentz, 1982). Many attribute treatment interaction studies have examined the interactive effects of making instruction less verbal by adding visuals to verbally-based instructional materials. Most researchers have concluded that, other

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things being equal, people having spatial and abstract abilities relatively stronger than their verbal abilities benefitted more from visual treatments than they did from exclusively verbal treatments (Cronback & Snow, 1977). An integrated system of creating instructionally effective pictures to supplement instructional text, however, has not yet emerged from the research literature.

The authors of this paper describe a method for integrating a highly regarded systematic approach to designing printed instructional materials with a little known method of analysing pictures for their educational effectiveness. The result is a system that educators can use to create pictures to supplement instruction and enhance concept acquisition. Research is reported in which guidelines derived from this approach were used to produce pictures, embedded in self-instructional print materials, that appeared to enhance the performance of adult learners with varying levels of visual learning skills.

The Need for Guidelines for Creating Educational Pictures

In their review of the research, Cronback and Snow (1977) concluded that well designed graphics (which included many different kinds of pictorial representations) can act as prostheses for learners with poor spatial ability. A number of studies on mental imagery and learning indicate that mental imagery appears to have a role in facilitating both higher, and lower level, concept learning (Kyllonen,Lohman&Snow, 1984;Levie&Lentz, 1982;Lohman, 1984; Sternberg & Weil, 1980; Taylor, Canelos, Belland, Dwyer & Baker, 1987). The use of analogical visuals (pictures that draw parallels between familiar and new concepts), either embedded or spontaneous, appears to be of particular importance in higher level cognitive processes (Kaufmann, 1980;Krueger, 1984;Miller, 1984). Research on the role of experimenter-provided visuals (pictures, diagrams and charts) in text-based and computer-based instructional materials supports the beneficial effects of adding visuals, especially for learners who are less proficient in manipulating verbal symbols, or low visual learners (Dwyer, 1978 and 1987; Fleming & Levie, 1978; Fleming, 1987; Levie and Lentz, 1982).

Over the past twenty-five years, Dwyer and his associates have consistently demonstrated that pictures supplementing text assist some individuals to learn from printed, programmed, instructional materials (Dwyer, 1978; Dwyer, 1987). From this large body of research, Dwyer concluded that "The use of visuals specifically designed to complement printed instruction can significantly improve student achievement of certain types of educational objectives" (Dwyer, 1987, p. 365).

Levie and Lentz (1982), in their examination of the relationship between pictorial and printed instructional materials, generated nine guidelines for the use of illustrations in text. These guidelines give educators good but very general advice, including such things as: a) the addition of pictures not related to the text will not enhance the learning of information in the text; b) illustrations can sometimes be used as substitutes for words or provide additional information; and c) learners may fail to make effective use of complex illustrations unless they are prompted to do so.

Fleming and Levie (Fleming & Levie, 1978; Fleming, 1987) have provided a promising beginning to the formulation of practical guidelines by summarizing into twenty broad principles what is known about key perception and memory variables that contribute to effective messages, including visual displays. These principles suggest recommendations that range from limiting the number of objects or groups of objects in a visual display to seven (the average number of items that people can perceive and store in short-term memory), to using visuals instead of words to illustrate concepts that are obviously spatial in nature. The most recent guidelines offered build on these principles (Fleming & Levie, 1993), giving greater attention to integrative theories and models than its predecessor (Alien, 1991).

Unfortunately, the numerous efforts that have been made to suggest guidelines for developing instructional visuals have generally not produced specific procedures for developing well designed pictures (Friedman, 1986; Alien, 1991). A number of researchers have, however, emphasized the importance of considering certain relevant variables, such as the learners' profiles of cognitive abilities, the nature of the learning tasks, and the overall context of instruction (Alexandrini, 1984, 1985; Stein, Brock, Ballard & Vye, 1987; Sternberg & WeU, 1980; Tversky, Kugelmass & Winter, 1991; Winn, 1982; Winn, Li & Schill, 1991) in the picture design process.

Merging Instructional Design and Picture Evaluation Principles

This section describes how widely accepted systematic instructional design principles for creating educational materials can be merged with picture evaluation principles to create pictures that act as "conceptual bridges" to effectively supplement text (Kozma & Bangert-Drowns, 1987). The procedure employs Gagne's model for designing instruction (Gagne, Briggs & Wagner, 1988), and Goldsmith's (1987) guidelines for analysing the comprehensibility of illustrations.

The resulting instructional design model that incorporates both Gagne and Goldsmith's models is illustrated in Figure 1. The model has four phases: (a) Analysis of Instructional Factors, (b) Development of Textual and Pictorial Outcomes, Instructional Techniques and Instructional Content, (c) Integration of Textual and Pictorial Elements, and (d) Validation of Instructional Materials. Each of these phases is described in the discussion that follows.

PHASE A: ANALYSIS OF INSTRUCTIONAL FACTORS

Phase A involves determining which learner, task and environmental factors should guide the development of the instructional materials. Learner factors (that is, the knowledge and capabilities that the learner brings to the instructional situation; referred to as pragmatic communication factors by Goldsmith) to be assessed include such things as reading ability, prior knowledge and

Figure 1.
Systematic Design of Instructional Pictures

Phase A: Analysis of Instructional Factors

1. Learner Attributes
   - Reading Ability
   - Prior Knowledge
   - Learning Style
   - Picture Literacy
2. Learning Task Analysis
   - Objectives
   - Target
   - Enabling
   - Textual/Pictorial
3. Learning Environment
   - Medium of Instruction
   - Instructional Setting

Phase B: Development of Textual/Pictorial Outcomes, Instructional Techniques & Content

1. Outcomes

Textual:	Pictorial:
Intellectual	Attentional
Verbal Info.	Affective
Cog. Strategy	Cognitive
Motor Skill	Compensatory
Attitude	

2. Instructional Techniques

Behavioral Objectives
Advance Organizers
Inserted Questions
Underlined keywords/phrases
Examples
Analogy

3. Instructional Content

Textual:	Pictorial:
Gagne's Events of Instruction	Goldsmith's Visual & Communication Factors

Phase C: Integration of Textual & Pictorial Elements
Goldsmith's Picture-Text Parallel Elements

Phase D: Validation of Instructional Materials
Subject Content Experts & Target Learners

learning style (cognitive strategies used to process new information) and picture literacy. Learning task factors are the target objectives (knowledge, attitudes and skills to be attained at the end of instruction) and enabling objectives (knowledge, attitudes and skills pre-requisite to attainment of the target objectives), which are derived from the task analysis of the overall instructional objective (Gagne, Briggs & Wagner, 1988).

Learning environment factors that need to be reviewed are issues like *how* (instructional medium) and *where* (instructional setting) the instruction will be delivered (Kozma & Bangert-Drowns, 1987).

PHASE B: DEVELOPMENT OF TEXTUAL & PICTORIAL OUTCOMES, INSTRUCTIONAL TECHNIQUES & CONTENT

The first step of Phase B involves translating each objective (derived from the task analysis) into one of Gagne's learning outcomes (i.e., intellectual skill, verbal information, cognitive strategy, motor skill and/or attitude), and then developing the particular textual instructional techniques to be used in the instructional materials. Gagne suggests a number of effective instructional techniques, such as, behavioural objectives, advance organizers, inserted questions, underlined keywords/phrases, good and poor examples, presented familiar information (e.g., use of analogy).

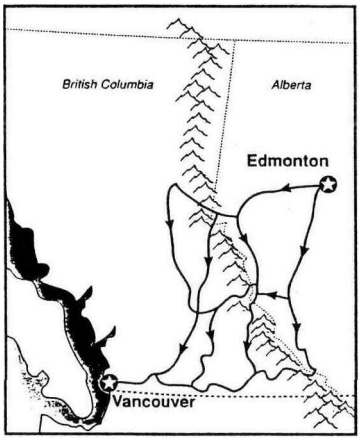
The techniques selected to assist the pictures to accomplish their outcomes are often determined by both the particular textual instructional techniques employed, and the function that the pictures serve. Levie and Lentz (1982) proposed that pictures serve four functions or outcomes: a) attentional: attracting and directing a learner's attention; b) affective: influencing emotions and attitudes; c) cognitive: facilitating learning by improving information acquisition, comprehension and retention; and d) compensatory: accommodating poor readers. One of the most effective pictorial techniques is the use of analogy, or the pictorial presentation of familiar images that are equivalent to less familiar textual information (Gentner, 1989; Gick & Holyoak, 1983; Holyoak, 1985). The use of analogical visuals to meet cognitive objectives is well supported in the research literature, possibly because analogy appears to lend itself well to visualization (Winn, 1982).

In the third step of phase B, the content and format that the instructional materials take is guided by Gagne's nine events of instruction (e.g., gaining learners' attention, presenting learning objectives, stimulating recall of prerequisite learning, presenting stimulus material, providing learning guidance, eliciting performance, providing corrective feedback, assessing performance, and enhancing retention and learning transfer).

Next, the picture design process involves first deciding on the subject matter of each picture, and then each picture's key visual features. Deciding on the subject matter of the pictures requires close consultation with individuals

Figure 2.
Example Application of Goldsmith's Model

Picture:



"Entering a new occupation is like taking a journey"

Element:

1. Syntactic unity - dark, thick border around picture; bold lines define alternate travel routes.
2. Semantic Unity - provincial borders indicated with broken line; British Columbia's coast and Vancouver Island indicated with shading; highways indicated with heavy lines; Edmonton and Vancouver indicated with large starred dots; mountains indicated with triangular symbols.
3. Pragmatic unity - clearly identifiable as a map of Alberta/British Columbia, as similar images are seen nightly on weather forecasts.
4. Syntactic location - shaded triangles indicate mountain range; shading along Vancouver Island indicates coastline.
5. Semantic location - triangular mountain symbols shaded on one side to indicate elevation.
6. Pragmatic location - incompleteness of map should not confuse adult viewers from North American culture.
7. Syntactic emphasis - position on page size; complexity of images; directionality of highway routes
8. Semantic emphasis - n/a.
9. Pragmatic emphasis - printed analogy is presented below the pictorial analogy.
10. Syntactic text parallels - picture is placed in upper left corner of page (optimal for catching attention of viewer).
11. Semantic text parallels - verbal labels for provinces and cities; verbal labels are the same in both textual and pictorial materials.
12. Pragmatic text parallels - maps of British Columbia and Alberta are familiar to Canadians; symbols used (mountains, highways, cities) are commonly used in Canadian publications.

familiar with the content of instruction (e.g., subject/content experts). Content ideas receiving consensual support from a small group of subject matter experts should be used in the pictorial illustrations.

To be instructionally effective, the key visual features should be based on sound learning principles and be comprehensible to the viewer. Goldsmith (1987) developed a set of guidelines for analysing the comprehensibility of illustrations intended to be supportive to educational text. These guidelines take into consideration both the communicative value of the picture, and the learner's level of visual literacy. Goldsmith's model, derived from a thorough review of the

research literature in the fields of education and psychology (Goldsmith, 1984), is based on educationally sound principles.

Goldsmith's analytical model consists of twelve elements formed by the interaction of four visual factors (based on learning theory) and three communication factors (based on communication theory), as indicated in Figure 2.

The visual factors are unity (clarity of single images), location (spatial relationships between two or more images within a single picture), emphasis (order in which different images attract viewer's attention), and text parallels (relationship between text and picture). The three communication factors are syntactic (recognizable spatial aspects of images), semantic (recognizable meanings of images), and pragmatic (knowledge and capabilities that the viewer brings to the situation). The critical pictorial features of each illustration can be determined by using the first nine of these twelve elements as guidelines:

1. Syntactic unity: refers to the discrimination of boundaries between images; clearly define the integrity of each image. (See Bogard, 1974; Deregowski, 1968; Deregowski, Muldrow & Muldrow, 1972; Ghent, 1956; Michael, 1953).
2. Semantic unity: refers to the comprehensibility of each image; give each image enough distinctive features to allow viewers to recognize it. (See Fussel & Haaland, 1978; Kennedy & Ross, 1975; Spencer, Harrison & Darvizeh, 1980).
3. Pragmatic unity: refers to the characteristics of viewers that affect their ability to identify an image; consider viewers' cultural & educational background; their familiarity with objects depicted in images, context of images, understanding of implied motion, and sequencing of images. (See Duncan, Gourlay & Hudson, 1973; Ellis, Deregowski & Shepherd, 1975; Freidman & Stevenson, 1975).
4. Syntactic location: relates to depth perception; assist viewer to perceive depth by using texture gradients, figural elevation and overlap, converging lines and shading. (See Benson & Yonas, 1973; Leach, 1978; McGurk & Jahoda, 1974; Olson & Boswell, 1976; Yonas, Cleaves & Petterson, 1978a; Yonas & Hagen, 1973).
5. Semantic location: concerns how each image contributes to perception of overall pictorial depth/meaning; place each image in correct environmental context by using accurate/familiar size and surrounding referents. (See Deregowski & Byth, 1970; Hagen & Glick, 1977; Omari & MacGinitie, 1974; Rock, Shallo & Schwartz, 1978).
6. Pragmatic location: refers to the manner in which viewers resolve ambiguous images; consider viewers' cultural and educational background/experience; reduce ambiguous images by checking potential viewers' understanding. (See Deregowski, 1971; Evans & Seddon, 1978; Nicholson & Seddon, 1977; Silliman, 1979; Sinha & Shukla, 1974; Yonas, Goldsmith & Hallstrom, 1978).

7. Syntactic emphasis: relates to the manner in which images attract and direct the attention of viewers; use colour, position, size isolation, complexity, tonal contrast, directionality, and/or implied motion to draw viewers' eyes to salient features of images. (Luria & Strauss, 1975; Mackworth & Morandi, 1967; Reid & Miller, 1980; Rutherford, Casey, Hasterok & Howell, 1979).
8. Semantic emphasis: refers to the power of the human figure/face to direct viewers' attention; use human figure/face to direct viewers' attention to salient features of images. (See Antes & Stone, 1975; Buswell, 1935; Wolf & Tira, 1970).
9. Pragmatic emphasis: concerns the natural viewing tendencies of viewers; present information that should be viewed first at top of page, and sequence it from left to right on page. (See Braine, 1972; Faw & Nunnally, 1973; Smith & Watkins, 1972; Webster & Cox, 1974; Yarbus, 1967).

After selecting appropriate subject matter and specific pictorial features, it is recommended that the pictures should be drawn by someone with good graphic design skills to minimize learner confusion that can result from poor images (Levie & Lentz, 1982; Zimmer & Zimmer, 1978).

PHASE C: INTEGRATION OF TEXTUAL AND PICTORIAL ELEMENTS

Phase C involves integrating the textual and picture components, or placing the pictures on the pages of text. The specific elements of Goldsmith's model that can be used as guidelines are the syntactic, semantic and pragmatic text parallels:

10. Syntactic text parallels: refers to the spatial and temporal relationship between text and image; when picture contains same information as text, present picture first. (See Bacharach, Carr & Mehner, 1976; Brody & Legenza, 1980; Smith & Watkins, 1972; Whalley & Fleming, 1975).
11. Semantic text parallels: relates to the matching of text and image by textual labels where appropriate; use exactly the same words in both the text and the images. (See Lachman, 1973; Snodgrass & Vanderwart, 1980).
12. Pragmatic text parallels: refers to the interpretation tendencies of viewers; consider viewers' cultural and educational background/experiences, their ability to understand complex images and the acceptability of specific images used. (See Campbell, 1979; Cook, 1980; Honeck, Sowry & Voegtle, 1978; Spangenberg, 1973).

Three additional visual design issues that were considered in the development of the pictures were: the use of realistic pictograms, to reduce the chance of learner misunderstanding (Goldsmith, 1984; Hodgson, 1985); the use of line-

drawings, as lower reading level subjects tend to learn better from less complex visuals (Dwyer, 1987); and the placement of each picture on the upper left-hand part of the page, as neurophysiological studies indicate that this may be the optimal viewing area (Hart, 1984).

PHASED: VALIDATION OF INSTRUCTIONAL MATERIALS

Phase D entails evaluating the textual-picture integration effectiveness by soliciting feedback from both subject content experts, and groups of learners for whom the materials were initially developed. This feedback should be used to guide final modifications to both text and pictures.

To summarize, the instructional design process proposed here includes both a textual and picture design component, using two complementary processes that can act as content checks for one another. This integrated textual/pictorial design model is recommended when the text and picture components are meant to provide the same information, in the verbal and visual modalities, hence functioning in a cognitive and/or compensatory manner.

Instructional Materials Created Using this Model

Wiesenberg (1990) used the integrated textual/pictorial instructional design model in an attribute by treatment interaction (ATI) study designed to investigate the role of analogical pictures in adult learners' acquisition of higher level concepts. Two directional hypotheses were tested.

1. Given that analogical visuals appear to facilitate the learning of more abstract or higher level concepts (Alesandrini, 1984, 1985; Krueger, 1984;Mayer, 1985;Miller, 1984), it was hypothesized that: "instructional materials supplemented with relevant analogical pictures will produce higher performance outcomes in all subjects than will identical instructional materials not supplemented with analogical pictures".
2. Given that learners who demonstrate a preference to use their visual sensory modality appear to learn more effectively from instruction that contains visual elements (Levie & Lentz, 1982; Paivio, 1986), and that learners who do not demonstrate this preference do no necessarily learn more effectively from instruction that contains visual elements (Kyllonen et al, 1984; Lohman, 1984; Taylor et al, 1987), it was hypothesized that: "instructional materials supplemented with relevant analogical pictures will produce higher performance outcomes in subjects demonstrating a more visually-oriented learning style".

SUBJECTS

A total of one hundred and twenty-one subjects, drawn from adult students enrolled in college and university preparation programs in three different Northern Alberta post-secondary institutions, participated in the study. Seventy-five were male and fifty-four, female. Subjects' average age was 31 years, and the average number of years of formal schooling attained before entering their present programs was 101/2. Independent groups t-test revealed that high visual subjects also achieved significantly higher ($t=3.73, p<.001$) mean Verbal Reason-

Figure 3.
Educational Objectives

Overall Educational Objective: ability to put together a career plan.
Type of Instructional Outcome: intellectual ability/skill

Target Objectives:

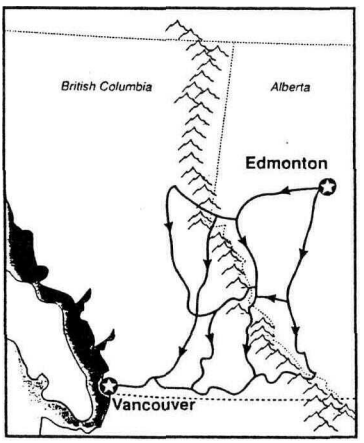
#1	#2	#3	#4	#5
know how to describe planning goals	know how to gather information	know how to create sub-goals	know how to make a master-plan	know how to evaluate a master-plan

Enabling Objectives:

#1	#2	#3	#4	#5
know how to set standards for goal attainment	know how to locate information	know how to choose guidelines	know how to sequence sub-goals	know how to anticipate problems
	know how to collect information		know how to check for conflict with other goals	know how to create ways around obstacles
	know how to evaluate information			know how to revise planning goals

Figure 4.
Page from "Text plus Picture" Version ofthe Instructional Booklet

Section 1. The Planning Process



Entering a new occupation
is like taking a journey

Imagine that you have just decided to drive to Vancouver for a holiday during the Christmas break. You have never driven there before, so you are looking forward to the new experience but are not quite sure how to prepare for the trip.

Now, think about the decision to enter a new occupation (that is, after all, why you are here in school). You are feeling very excited about this major life change and possibly a little unsure about how to go about making the change.

The experience of entering a new occupation and taking a trip along an unfamiliar route are in many ways quite similar. The way that you choose to prepare for both can influence your chances of eventually reaching both kind of goals.

First, being very well informed about your new occupation is important. In a similar way, if you did not know where Vancouver was located, you would be very unlikely to arrive there (you may end up somewhere else instead).

Second, finding out as much as possible about your intended occupational choice (isthere more than one way to enterthis occupation?) is somewhat likefinding out if there is morethan one highway to Vancouver. Knowing about all ofthe possible routes allows you to choose the one that suits you best.

Third, the often very long process of entering an occupation can be made more manageable (and often more enjoyable) if tackled in shorter steps. This is like breaking the long trip of several kilometers into a series of shorter trips. Breaking the journey into steps can make it seem less of a "long haul" and more managable.

ing scores (33.03; SD=8.03) than did low visual subjects (27.06; SD=10.11). In other words, higher visual subjects tended to have better verbal reasoning skills than did lower visual subjects.

METHODOLOGY

The research design used in this experimental field study was a 2 treatment (instructional condition) by 2 level (high versus low visual learning style) factorial design. Once categorized by learning style (68 low and 61 high), subjects were randomly assigned to the two instructional conditions. The two instructional conditions contained almost equal numbers of subjects (65 in the text only and 64 in the text plus analogical pictures).

The dependent variable in the study was the subjects' acquisition of planning concepts at two different levels of complexity, as measured by a multiple-choice test (comprehension) and open-ended questionnaire (knowledge only). The independent variables were the two instructional conditions, and the learning style. As the research literature indicates that both prior knowledge of the concepts to be learned and verbal reasoning ability significantly affect learning outcomes (Dwyer, 1987), these variables were both treated as covariates in this study. Prior knowledge of the planning process was measured in a pre-test session using the performance outcome measure (multiple-choice test), and verbal reasoning ability was measured by the Verbal Reasoning Subtest of the Differential Aptitude Test (see Bennet, Seashore & Wesman, 1982).

Reviews of visual learning as a learning style indicate that this style consists of two unrelated aspects of an individual's information processing behaviour: (a) an ability to use mental imagery, and (b) a propensity to use this ability (Ernest, 1977; Richardson, 1977; Katz, 1983). Visual learning styles were determined by combining subjects' standard scores on an objective measure of visual skills (Space Relations subtest of the Differential Aptitude Tests, see Bennett, Seashore, & Wesman, 1982) and a subjective measure of information processing preference (Individual Differences Questionnaire, see Paivio, 1986). Subjects' learning style was then categorized as either high (if their combined standard scores were positive) or low (if their combined standard scores were negative), a procedure used in previous studies (Ernest & Paivio, 1971).

DEVELOPMENT OF THE INSTRUCTIONAL MATERIALS

In this study, the overall educational objective of the instruction was to teach subjects how to put together a career plan. The instructional materials design process began with the creation of a competency profile developed using a competency-based system of skill analysis (Block, 1974). This profile was then used to clarify both target and enabling objectives (see Figure 3). The content of

the textual instructional technique (a five stage travel planning model) was developed using Gagne's nine events of instruction.

The picture design process began with the decision to use visual analogies to duplicate the content of the textual analogy, to serve both a cognitive and compensatory function (Levie & Lentz, 1982). The pictorial equivalents of the printed analogies were created by first consulting with several subject content experts, and then using Goldsmith's twelve elements as guidelines for determining the salient features required to create the visual depictions of each textual analogy, as indicated in Figure 2. The pictorial analogies were then drawn by a graphic artist. Figure 4 is the first page of Section 1 of the "textual plus picture" version of the instructional booklet.

Content validity of the instructional booklet was established through independent, subject content experts who separately rated: (a) textual message, (b) pictorial message, and (c) textual and pictorial messages together, according to the educational objective each text-picture set was designed to achieve. Overall, the text and pictures were rated by experts as meeting the stated educational objectives at least 75% of the time, with most of the text and corresponding pictures meeting these objectives 100% of the time. Representative groups of adult learners also validated the comprehensibility and appropriateness of the textual and pictorial analogies chosen.

RESULTS AND DISCUSSION

Analysis of covariance, with subjects' prior knowledge of the planning process and verbal reasoning ability acting as the covariates, was used to test the two hypotheses.

The first hypothesis was not supported by the results. When the effects of subjects' prior knowledge and verbal ability were removed, no main effects were demonstrated on either performance outcome measure for instructional condition. The pattern of responses on the two different outcome measures were different, however, depending on subjects' learning style. Non-significant trends in the analysis of the multiple-choice test post-scores (comprehension task) lent some support to the hypothesis for low visual subjects, while non-significant trends in the open-ended questionnaire scores (knowledge task) were exactly the opposite to results hypothesized.

All subjects achieved significant gain in their comprehension of planning concepts across both instructional conditions ($p<.05$). The low visual subjects achieved significantly higher overall performance scores than did the high visual subjects. The subjects learning style, not the instructional condition, was the critical factor in the successful learning of the planning concepts. The more intriging finding was that higher visual and verbal subjects (those subjects who had the highest scores on both the Spacial Relations and Verbal Reasoning Subtests) appeared to be unaffected by the analogical visuals on the comprehension task, but negatively affected by them on the knowledge task. Low visual

subjects performed in exactly the opposite manner. Pearson Product Moment correlations calculated on all nine variables in the study revealed that low visual subjects were relying more heavily on their spatial skills to perform both tasks, than were the high visual subjects.

The second hypothesis was also not supported by the results. Non-significant trends in the data on the knowledge task scores indicate a tendency towards interaction in the opposite direction to that hypothesized, with the high visual subjects achieving less in the "text plus picture" than they did in the "text only" instructional condition. While most of the low visual subjects made better gains on the comprehension task,a small group of low visual Native subjects performed both tasks in exactly the opposite manner to that hypothesized; their performance being apparently unaffected by the level of complexity of the task. It appeared that in their case, the visuals somehow compensated for their lack of visual skill. Pearson Product Moment correlations indicated that Native subjects, versus their non-Native counterparts, had a stronger preference to use imagery (.57 versus. 19) in the comprehension task, and spatial ability (.40 versus. 16) in the knowledge task.

Overall, these results seem to indicate the analogical pictures may serve both a positive role (perhaps as conceptual pegs for lower ability, Native learners in knowledge tasks) and a negative role (perhaps as distracting stimuli for higher ability, Native subjects in knowledge tasks, and for lower ability non-Native subjects in comprehension tasks). 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 (Cronback & Snow, 1977; Peeck, 1987; Winn, 1982). The results for the low visual Native subjects seemed to support a compensatory model of information processing that suggests that visuals can "short-circuit" learning by reducing the cognitive processing load for low ability learners (Corno & Snow, 1986).

The results of this study imply that a careful analysis of both the learners' preference and ability to process visual information, their individual profiles of verbal and visual abilities, and the level of complexity of the learning task are all important considerations in the design of text-based visually enhanced, self-instructional materials. These results lend support to the use of analogical pictures to complement instructional text designed to teach lower level concepts to learners having relatively low visual skills, or high level concepts to learners having relatively high visual skills.

CONCLUSION

The paper describes a method for producing educationally effective pictures to accompany textual instructional materials for adult learners. The method starts with Gagne's model of systematic instructional design, and extends it by incorporating Goldsmith's method for designing visuals to supplement printed text. The method for designing visuals is based on empirically validated visual

perception and communication principles. The approach of integrating textual and pictorial development has been used successfully in one research study to produce pictures enhancing the learning outcomes of adult learners with different levels of visual learning skills.

Given the current absence of specific visual development guidelines for educators, this model provides a promising method for designing educationally sound pictures that can function in a compensatory manner for adult learners at the pre-university and college level.

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Mediaware Review

Creating Desktop Presentations with Astound

L F. (Len) Proctor, Editor

System Information and Requirements

Astound ™
Gold disk Inc
P.O. Box 789, Streetsville
Mississauga, Ontario. Canada. L5M 2C2
Customer Service (416) 602-4000
Tech Support Phone: (416) 602-0395
Tech Support Fax: (416) 602-0393

System Requirements:

- Macintosh Plus or later, 68020 or faster recommended
- 2 MB minimum but 4 MB of RAM memory or more is recommended)
- At least 40MB hard disk drive (although larger drives are recommended)
- System 6.0.8 , but system 7 or later recommended
- QuickTime™, version 1.5 or later

Program Description

Astound is a desktop presentation production package. With this software, the user can prepare transparencies, presenter notes and attendee handouts. The tools available for this purpose include a full text editor, spelling checker, drawing tools, a graphing utility, slide sorter and an outliner. Graphics created with other applications and stored as PICT, TIFF, and EPS files can be imported and incorporated into any presentation. Similarly, QuickTime clips, Gold Disk's own animation sequences, AIF and SND sound files, can be placed anywhere in the slides produced by this program. With the appropriate file management and the runtime player programs included in this package, presentations created on a Macintosh platform can be displayed on a MS-DOS platform but not revised .

Program Installation

The installation instructions are brief and to the point. To get started, insert Disk 1 of Astound program into the floppy disk drive, double-click on the Astound Installation icon, click on the startup screen, approve the hard drive selected for installation and enter your name on the registration card. After inserting and removing nine high density floppy disks at appropriate screen prompts, installation will be complete. The Astound folder placed on the hard drive now contains the main program, a dictionary, Windows and Macintosh players, and a copious number of templates, sound files, clip-art files, fonts, backgrounds, animations and tutorial support files. In total, there are over 700 files that require about 26 MB of storage space on the hard drive.

Basic Functions

The outliner, one of the most powerful and often overlooked features of any presentation program, is extremely useful because of the ease with which a presenter can organize and reorganize the main points of the presentation. In Astound any text that is entered into the outliner appears on the transparencies as titles or bulleted points. Once entered, the text can be edited, formatted and revised for display purposes without ever having to leave the Outline View mode.

Slides can be created with or without the use of background templates. Templates (master slides) are provided for 9" black & white screens, 13" color screens, 35mm slides, overheads and powerbooks. The use of a master background is highly recommended because of what it adds to the cohesiveness and unity of any presentation. A standard set of graphics tools for drawing and filling squares, circles and odd shaped figures is also part of the main package. Editing clip-art or other forms of graphics however, still has to be done outside Astound program. However, a good library of clip-art images has been provided to assist the presenter in illustrating the topic being presented. If graphs and charts are required, data can be entered directly into the data sheet or imported from Excel or Lotus 1-2-3 compatible spreadsheets

A battery of special effects has also been provided to help add variety and vary the pace of the presentation. For example, bulleted text items can be dissolved or "flown" onto the screen, one at a time, until the entire screen has been built up to the desired level. Special transition effects such as wipes or fades can also be invoked when changing from transparency to transparency.

The inclusion of animation and multimedia capabilities is new. The animation feature uses actors. By definition, an actor, is really a series of still pictures, which when presented in rapid succession, creates the illusion of motion on the screen i.e.. animation. Actors may be inanimate objects such as arrows or animate objects such as people who "walk" about on the screen and point to captions or objects in the screen in order to draw the viewers' attention to their specific details. Graphs and charts may also be animated as they are displayed on the screen. Assuming the sound has already been digitized, adding sound clips to the slide is as simple as clicking on the add sound icon,

selectingthesound file to be used and clicking on the "add sound"button. Then, when the slide first appears on the screen, the sound file will be activated and the sound will be played back. Finally, any object on the screen or sound file associated with the screen can be controlled by interactive buttons. Buttons may also be used to help the presenter navigate through the presentation.

To print the handouts, presenter notes and content outlines is a matter of calling up the print function, and select the appropriate icon. For handouts the user is offered a choice of printing 2, 3, 4, 5, or 6 thumbnails per page. Space for attendee notes can be made. Presenter notes also contain a miniature of the slide and space for the notes on the bottom half of the page. Outlines may be printed in either main heading form or main headings complete with all sub-headings. The presentation can also be printed to 35mm slides if the equipment is available. If it is not, the files may be sent to a jobber, printed, and returned to the user as 2x2 projection transparencies. This is a nice feature both for backup purposes or for when presentations are given where the presenter is not sure that a computer LCD tablet or other projection device will be available.

Documentation

The Astound documentation is well laid out and easy to follow. For those users who don't want to read the entire main manual, there is a quick and easy "Getting Started" tutorial which quickly orients the user to the most often used features of the program. Appropriate disk files have also been included in the tutorial so that if something doesn't work right the first time, the user is not frustrated by having to complete one section accurately before being able to proceed to the next lesson. While the table of contents does not include page numbers for chapters, the index makes up for this deficiency by using common terminology and direct reference to page numbers. Both manuals are richly illustrated with screen displays to help the novice user remain oriented within the program.

While the main user's guide and the getting started manual focus on the technical or operational aspects of creating slides, a slim 8 page guide on creating dynamic presentations has also been included with the documentation. It is full of suggestions for selecting content, screen layout, emphasis techniques and color selection. Novice users who take advantage of these production recommendations will avoid many of the common, visual pitfalls often associated with the use of transparency display devices.

Observations and Recommendations

This program is large (1.8 meg) powerful, and versatile. Users can create professional looking presentations quickly and easily. Its import capabilities allow data from spreadsheets, QuickTime clips, TIFF and PICT graphics and AIF and SND sound files to be incorporated into the presentation. Slides from Astound files can also be exported as PICT files and QuickTime clips. Animation and interactive capabilities have been added to an already fine set of text editing and drawing tools. Over time the existing libraries (20 meg) of sound

files, clip art and animations can be enhanced by purchasing commercially available products or producing locally prepared resources.

If there is one drawback to using this program, it is speed. Even with the heap size set to 10 meg and running on an Quadra 840AV Mac, it takes a significant amount of time for complex slides to be displayed and to change. With slower machines that have less memory, this apparent lack of speed could be a limiting factor. To maximize performance, the documentation suggests that users should limit themselves to a few objects per slide, keep object transitions consistent, and keep object exit animations to a minimum. Speed of operation, on the other hand, has be be balanced against versatility and ease of use. Given a choice between a fast, user hostile environment and a slower, user friendly environment, user friendliness would win out over operational speed. As newer, faster machines such as the PowerPC come to market, concern for operational speed will become less and less.

The ability to convert Microsoft PowerPoint and Aldus Persuasion files to Astound files is valuable in the sense that much of the investment made in creating the original presentations can be recaptured. It only takes about 2 minutes to convert ten PowerPoint slides to Astound slides. However, in doing so, only the text and graphics transfer. Transitions and special effects in the PowerPoint presentation are lost. While not yet tested, the cross platform capabilities of being able to author Astound presentations on the Mac and present on MS-DOS equipment is intriguing. PowerPoint has this option and seems to go both ways quite seemlessly.

Given the wide variety of equipment found in most educational institutions, software developers should be encouraged to continue building this kind of capability into all programs. Rapid changes in hardware and operating systems make cross platform and upward compatibility of programs like Astound a valuable asset. On the surface hardware and software costs may seem to be expensive, but when considered on a more long term view, these costs are often small when compared to the investment of time and labor made by the presenter to create any format of presentation support media. Tools like Astound can do much to facilitate the organization, production and presentation of high quality instruction.

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Book Reviews

Diane P. Janes, Editor

Messages, Meanings and Culture: Approaches to Communication Criticism by Malcolm A. Sillars. New York: HarperCollins College Publishers, 1991. ISBN 0-673-46030-4 ($19.60)

Reviewed by Richard F. Lewis

Malcolm A. Sillars textbook introduces students to how critical theory can be used in message analysis. He suggests that the text can be used in many areas in communication studies. There are two reasons why readers *otCJEC* might want to read this book. Media literacy educators will want to examine it as a comprehensive text to teach their students how to apply different communication theories to the message. The rest of us can use the book as a primer of critical theory, teaching us some new concepts absent in most of our undergraduate and graduate work.

The book focuses on the message. This in itself is not new. What is new is the focus on the message in context and the notion of the critic. Sillars suggests that the message is not only produced by society but that it can shape society itself. Any discussion of message therefore must deal with its impact and not just with the message itself. Sillars' second important notion is that of the critic. I suspect that most of us would use techniques contained in the early chapters of the book as we analyze messages. We would try to objectively determine the content of the message. Many media literacy curricula on advertising suggest good schemes for describing the content. They lack guidance on what to do once the content is collected. Sillars' work is rich with suggestion on what to do once the message has been described. The critic is important because of his/her effect on truth or objectivity. Some theories want the critic to be as objective as possible. Other theories suggest that the critic affects the process and thus should recognize and deal with the effects of the criticism.

Sillars begins by categorizing eight approaches to criticism as belonging to either the common-sense or the deconstruction tradition. Common-sense theories include accurate interpretation, formal criticism and neo-classical criticism. Deconstructionist approaches include semiotics, value analysis, narrative analysis, psychoanalytic theories and ideological criticism.

Chapter Two: Analyzing Messages, defines the message and then attunes the reader to the tools which all approaches to criticism require. Sillars provides concrete suggestions for basic message analysis which will allow all other critical approaches to be used. Each of the next eight chapters deals with one approach. Sillars describes each approach, tells the reader how to use it, delineates its assumptions, and exposes problems with the approach. The book is replete with examples drawn from television programs and the United States political system. Unfortunately, the book assumes that the United States is its universe, drawing no information from events and messages from the rest of the world.

Sillars suggests that the common-sense approaches to criticism (Chapters 4-6) assume that a trained critic can uncover the "truth" behind a message. They assume that there is a truth there to be discovered and that everyone negotiating the message could uncover this truth. Critics of these approaches suggest that there is no truth, only a representation of reality, constructed by one mind to communicate with others.

Deconstructionist approaches want the reader to look beyond the message itself to deeper meanings and contexts. Semiotic analysis (Chapter 6) suggests that messages consist of signs, codes and conventions which comprise values, myths and ideologies which allow us to communicate. The critic must look beyond the message itself to see what it connotes since meaning is negotiated between the message and the audience. Value analysis (Chapter 7) examines texts to determine how they define the culture. The values in the texts reflect the value system of a culture. Sillars describes the major American value system. Canadians appears to share some of the value system Sillars describes. Narrative analysis (Chapter 8) seeks to understand a culture through the stories it tells. Various rhetorical and structural analyses characterize narrative analysis. Psychoanalytic criticism (Chapter 9) which is based on Freud's ideas assumes that we can analyze texts to uncover the interaction between the conscious and unconscious minds. Ideological criticism (Chapter 10) uncovers the political agenda behind the messages. It always examines power relationships within the culture.

Sillars does not favour one method over the others. He suggests that your assumptions and objectives as *a* critic will govern which approach(es) you use. Various approaches borrow from each other, so there are common elements. I like to think of critical approaches like learning theories: we can use elements from all of them making our criticism much more powerful. I wish that Sillars had reinforced that point in a concluding chapter. As the book stands, Chapter Ten on ideological criticism ends. When you turn the page for the summary, you are greeted with the Bibliography.

The *book* is very readable, keeping jargon to a minimum and simplifying content wherever possible. Although all references are American, Canadian readers will identify with the television examples and with some of the references to the political system and Constitution of the United States. The book provides an excellent introduction to new theories of communication and how they can be applied. Its extensive bibliography will help the reader locate many interesting and sometimes rare material.

REVIEWER

Dr. Richard F. Lewis is Associate Professor of Communication Studies at the University of Windsor. He serves as Chair of the Board of Educational Advisors of CBC Sesame Street. He has been President of AMTEC and Editor of the *CJEC*.

Internet: Getting Started, Edited by April Marine, Susan Kirkpatrick, Vivian Neou and Carol Ward. New Jersey: PTR Prentice Hall, 1994. ISBN 0-13-289596-X ($28.00)

Reviewed by Diane P. Janes

Over the last year or so an increasing number of the students I work with, both at the undergraduate and graduate level, and many of the faculty I work with have come to me with Internet questions. Many are very basic, queries on "how do I log on?" or "what is the internet?". Some questions are from more experienced users regarding telnet or FTP. These questions led me to investigate the Internet, which is where I discovered an earlier version of *Internet: Getting Started.*

With its publication by Prentice Hall as part of their Internet Information Series, *Internet: Getting Started* joins what appears to be a proliferation of books and journals on the issues that make up the Internet. Prentice Hall notes that the Series, made up of books by SRI International (the original sponsor *of Internet: Getting Started)".*. .are intended as reference sources for users, implementors, designers, and students of the Internet and the protocols it uses. The Internet Information Series is meant to be a guide both to understanding how to use certain networks for particular purposes and to understanding what our world will be like when these new resources have become as commonplace as the telephone is now".

Internet: Getting Started is loosely divided into two parts with twelve chapters and nine appendices. The first half of the book is comprised of Chapters One through Six. Content covered includes definition of the internet, discussion of the types of network access, overview of the steps to begin network access, discussion of the costs of connecting, an extensive list of service providers, both commercial and research-based, within and outside of the United States and finally, present NSFNET backbone Acceptable Use Policy.

The second half of the book, Chapters Seven through Twelve, cover the Internet itself. Discussed are Internet "concepts" such as RFC's, Protocols, Internet Protocol (IP) Addressing, the Domain Name System and network security; Internet applications, such as electronic mail, file transfer, and remote login; Internet organizations, both national and international; and resources available on the Internet.

The book comes with a very comprehensive set of appendices including an Acronym List in Appendix I and a list of international Internet connections in Appendix VIIL

Overall, *Internet: Getting Started* is a very readable book for both the experienced user as well as the novice. Using relatively plain language, it moves through the concepts of the Internet with little difficulty. The pages are well laid out and the index reasonable to use. One of my favourite features in the book is that it is littered with electronic addresses so that readers may contact individuals, companies or countries personally if they need to. I also like its international approach. You never seem to say to yourself "...but I live in Canada...how does this apply to me?".

The bibliography and references are practical, listing, when available, the directions a user would need to retrieve the document from the Internet.

I have only one caution. The Internet is growing at such a rate that information through traditional published sources may be convenient, but can be dated quickly. The editors recognise this reality and leave their email address for readers to send any corrections or additions to the book. For those of you still not explorers of the Internet, they do leave their traditional mail address, voice mail telephone numbers and fax numbers.

REVIEWER

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