Effects of Active vs. Passive Review Strategies on Recalling Information from an Interactive Video Instructional Programme

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ABSTRACT: The purpose of this study was to investigate the effect of two review strategies on recalling information from an interactive video program. The strategies compared varied in terms of the amount of overt activity required from the learners. The conclusions suggest that the question of interactivity must be examined more closely to take into account: a) the quality of the strategy provided; and b) how different types of strategies work depending on learners and desired learning outcomes.

One of the most attractive features of interactive video for instructional designers is the possibility of integrating the visual capabilities of video with the interactive capabilities of the computer (Alien, 1986; Scheffer & Hannafin, 1986; Smith, 1988). Although some interactive strategies can be incorporated into any kind of medium, the processing capacities of the computer facilitates the design of interactive instructional programs.

Blum-Cohen (1984) defines an interactive program as one where "the student is actively involved in responding to an instructional lesson..." (p.19). Thus, at the heart of the concept of interactivity is the notion of active participation of students during the learning process.

The facilitative effects of progressively interactive video instruction were examined in a study by Scheffer and Hannafin (1986). The authors investigated the effect of four versions of an interactive video program ranging from linear video to a fully interactive variant using questions, branching, and remediation on achievement and efficiency of learning. The results indicated that, in general, progressively interactive video instruction produced increasingly greater learning, but that the overall efficiency suffered. Low and high achiever learners, however, responded differently to the different interactive presentations in the study.

It is important, however, to differentiate between different purposes for using interactivity. According to Alien (19 86) interactivity has been promoted from two distinct perspectives. The first perspective, based on generative

models of learning, uses interactivity as a way of providing students with a greater control over the learning process. The potential of interactive video to provide learner control is promoted from the point of view of providing greater individualization, motivation, and responsiveness to learning needs (Blum-Cohen, 1984; Hannafin, 1984,1985; Hannafm & Colamaio, 1988; Hannafm & Phillips, 1987; Ho, Savenye, & Hass, 1986; Laurillard, 1984; Pawney, 1983). The second perspective, which is relevant to the present study, emphasizes the use of interactivity to control "mathemagenic" activities (Rothkopf, 1970), that is, those learner activities that influence learning. Learners can exhibit covert mathemagenic activities by mentally rehearsing and manipulating the material to be learned. On the other hand, strategies such as the inclusion of questions during and after instruction require learners to interact actively with the instruction (Ho, Savenye, & Hass, 1986; Schwier & Misanchuk, 1988).

The notion that providing learners with opportunities to practice and review information facilitates acquisition and retrieval has been established by previous literature with respect to a variety of media such as print, slide-tape, film, and video (Ausubel & Youssef, 1965; Brunning 1968; Coldevin, 1976; Lumsdaine, 1963; Rickards & DiVesta, 1974; Rothkpof, 1968; Yost, Avila, & Vexler, 1977). These opportunities help direct learner attention to relevant content that may have been missed during initial instruction (Ho, Savenye, & Hass, 1986). Questions arise, however, about the most effective methods of designing practice and review activities. Studies have attempted to compare strategies such as type and position of questions (Ausubel &Youssef, 1965; Dayton & Schwier, 1979; Rickards & Di Vesta, 1974; Yost, Avila, & Vexler, 1977), massive vs. spaced review (Coldevin, 1976), and use of questions vs. summary reviews (Brunning, 1968).

In a recent study, Schwier and Misanchuk (1988) compared the effect of overt strategies (embedded questions) vs. covert strategies (summary frames) in learning from computer-based materials. The results showed that the use of embedded questions was more effective only for learners who had a high "perceived need for training." Learners with low "perceived need for training" achieved similar amounts from all treatments used.

Research on interactive video has compared the effect of optional vs. non optional reviews (Ho, Savenye, & Hass, 1986) and relevant practice in the form of embedded questions (Hannafin, 1987; Hannafin & Colamaio, 1988; Hannafin, Philips, & Tripp, 1986). The effect of these activities was found to vary depending on the learning outcome and their combination with other instructional strategies. These studies, however, focused only on presence or absence of practice and review without comparing different design strategies for promoting information processing and retrieval. This was the focus of the present study.

The purpose of this investigation was to assess the effect of two review strategies on recalling information from an interactive video program. The strategies compared varied in terms of the amount of overt activity required of the learners. One strategy require *1* students to participate overtly in the

review by using questions and feedback. The second strategy consisted of a step-by-step review which reiterated the information presented; therefore it did not require students to interact overtly with the information.

The following questions were addressed:

a) Will a review strategy requiring a more active participation of learners through the use of embedded questions (Active Review), produce a greater recall of information than a step-by-step review which simply reiterates the previous information (Passive Review)?;
b) Will the provision of review (Active and/or Passive) result in greater learning than providing no review?; and
c) What will be the effect of the different strategies in learning efficiency measured as amount of time required to complete the instruction?

The study examined the effect of these strategies on two types of recall: Recall of factual information and recall of procedures. Previous research on interactive video has indicated a differential effect of practice for these outcomes (Hannafin & Colamaio, 1988; Hannafm, Phillips, & Tripp, 1986).

Similar questions have been investigated with print-based materials (Brunning, 1968) and computer-based instruction (Schwier & Misanchuk, 1988). Research on the instructional variables involved in the design of interactive video materials is needed in order to understand the role of the technology in supporting learning and to provide practitioners with empirically validated instructional design guidelines (Hannafin, 1985; Hannafin & Phillips, 1987; Palmer & Tovar, 1987; Smith, 1988).

METHOD

Subjects

The subjects were 30 university students majoring in the natural sciences (Biology and Chemistry) with no previous knowledge of the instructional content of the interactive video.

Interactive Video Instructional Treatments

The videodisc used for this study was developed at the Graduate Programme in Educational Technology at Concordia University. It was commissioned by the Radiation Safety Committee of the university and was designed to teach procedures for carrying out radioactive contamination assessment (for high and low level radioisotopes) and emergency procedures to be followed in case of a radioactive spill (area and body decontamination). For biochemistry students experimenting with radioactive materials, knowledge of these procedures is crucial in order to maintain a safe work environment. The

program runs in a two-screen interactive video system which includes a videodisc player and a microcomputer. The videodisc contains a bank of visual images, including both motion sequences and still visuals, which illustrate the steps in carrying out the procedures, the tools and equipment required, and general information . The program was evaluated during the summer of 1988 by obtaining feedback from experts and a sample of the target audience . The results showed very positive learning and attitudinal outcomes.

The instructional treatments were developed from one of the modules of the videodisc dealing with the "swipe check," a procedure for assessing the presence of low level radioisotopes. Three treatments were developed from the same bank of visual images, corresponding to each of the experimental conditions of the study: Passive Review, Active Review and No Review (control).

No Review. An instructional segment consisting of video and still frames, with accompanying computer text screens, presented information about: a) when the Swipe test is used; b) tools and materials necessary to carry it out, and; c) the steps of the procedure.

Passive Review. After watchingthe instructional segment described in the No Review condition, students were presented with a frame-by-frame review of the application of the swipe check method and the tools necessary to carry it out. Following this, there was a step-by-step review of the procedure. A computer text screen described the step of the procedure to be reviewed, accompanied with a frozen image of the beginning of the step on the video monitor. When the students pressed "return" the videodisc demonstrated the step and then stopped (freeze-image) at the beginning of the next step.

Active Review. This review was identical to the review condition except in the degree of involvement required of the student. Rather than simply reading the information on the computer text screens and watching the review video segments, the student was prompted, through questions, to identify each tool and step of the procedure throughout the review process. Feedback was provided on the computer monitor and the videodisc demonstration.

Dependent Measures

Recallposttest. A 40-point constructed response test was used to measure recall of the information presented in the instruction. The test contained three questions that covered the main three items of information presented in the module [(i. e., a) when to apply the swipe test; b) tools and materials required; and, c) the steps of the procedure]. The first two questions required students to recall facts. The third question dealt specifically with recalling the steps of the procedure. Subscores for each question were 3 points for the first, 9 points for the second, and 28 points for the third. Detailed scoring instructions were prepared to include basic key words and their associated values for scoring students responses. The test was independently scored by two research assistants who were not aware of the group membership for each individual

test. Inter-rater reliability was found to be .95. When discrepancies occurred, the final score was calculated by averaging the scores produced by the two raters.

Instructional time. A measure of the amount of time required to complete the instruction was included in order to assess its relationship with the instructional treatments. This measure provided an indication of the comparative efficiency of more interactive strategies and has been used by researchers in similar studies (Dayton & Schwier, 1979; Scheffer & Hannafin, 1986; Schwier & Misanchuk, 1988).

Procedures

Participants were randomly assigned to one of the three experimental conditions. After a brief introduction to the study and the operation of the system, they completed the module corresponding to their treatment group. A research assistant kept track of the time it took students to complete the instruction. Immediately following the lesson, the students completed the posttest. All instruction and testing was administered individually.

Design and Data Analysis

The design used for the present study was a Posttest Only Control Group Design (Campbell & Stanley, 1966). The independent variable consisted of three levels of instructional review (Active; Passive; No Review). The dependent variables were: total recall score, partial scores (facts and procedures) and instructional time. Data were analyzed using multivariate analysis of variance (MANOVA) with univariate tests (ANOVAs) for total score and time. A second MANOVA was carried out using partial scores from the test in order to separate recall of factual information from recall of the procedure. Mean score differences for the levels of instructional treatments were compared using the Scheffe method.

RESULTS

Total Score and Time

The Hotelling trace criterion for multivariate analysis showed an overall significant effect of the experimental treatments, $F\ (4,\ 50) = 49.25,\ p < .01$.

Univariate comparisons between means for each dependent measures showed significant differences for recall scores, $F\ (2,27) = 3.99,\ p < .05$, and instructional time, $F\ (2,\ 27) = 103.36\ ,\ p < .01$.

Mean recall scores and standard deviations for each of the treatments are shown in Table 1 (see following page).

Scheffe multiple comparison tests revealed that the Passive Review condition was significantly higher than the control condition ($p < .05$). No significant differences were found between any other treatment means.

TABLE 1
Means and Standard Deviations for Total Recall Scores *(Maximum=40points)*

	Instructional Group		
	Active Review	Passive Review	No Review
M	27.90	31.25	23.40
SO	5.07	4.52	8.38

TABLE 2
Mean and Standard Deviations for Time in Minutes

	Instructional Group		
	Active Review	Passive Review	No Review
M	31.60	19.80	8.80
SD	5.31	2.85	1.13

Table 2 shows the means and standard deviations for instructional time. Scheffe" tests revealed significant time differences among all treatment conditions ($p < .01$).

Recall of Facts, Recall of Procedures, and Time

An analysis of partial scores of the test was carried out to separate those items requiring students to recall facts (i.e., tools and application of the swipe test method), from those where they were asked to recall the steps of the procedure.

The Hotelling trace criterion for multivariate analysis showed an overall significant effect for the experimental treatments, $F(4, 50) = 31.99, p < .01$.

Univariate comparisons between means for each dependent measures showed significant differences for procedure scores, $F(2,27) = 3.54 p < .05$, and instructional time, $F(2, 27) = 103.36, p < .01$. No significant differences were found for facts.

Mean procedure scores and standard deviations for recall of procedures under each of the treatments are shown in Table 3 (see following page).

Scheffe multiple comparison tests revealed that the Passive Review condition was significantly higher than the control condition ($p < .05$). No significant differences were found between any other treatment means.

Table 4 (see following page) shows the means and standard deviations for facts.

TABLE 3
Means and Standard Deviations for Recall of Steps in the Procedure *(Maximum = 28 points)*

	Instructional Group		
	Active Review	Passive Review	No Review
M	19-20	21.60	15.45
SD	4.35	4.05	6.78

TABLE 4
Means and Standard Deviations for Recall of Facts *(Maximum = 12 points)*

	Instructional Group		
	Active Review	Passive Review	No Review
M	8.70	9.65	7.95
SD	1.31	1.54	2.24

DISCUSSION

The results of this study suggest that providing students with a step-by-step review of previous information (Passive Review) was the most effective strategy for inducing recall of the information presented in the program. The analysis of the partial scores showed that for procedures, the Passive Review condition produced significantly better recall. Review did not make any difference for recalling facts. The time required for learning varied significantly according to the amount of interactivity provided: that is, the greater the interactivity, the more time it took students to complete the instruction.

Providing learners with an active strategy in the form of questions did not have any significant effect on the students' recall scores. Furthermore, it was significantly less efficient than both the control and the passive review strategy.

The interactive strategies used in this study involved simple post-questions requiring students to recall a fact or step in the procedure. Thus, the quality of this overt interaction did not add significantly to the learning strategies of the subjects; in fact, its introduction within the review resulted in a poorer and less efficient performance. As Schwier and Misanchuk (1988) suggest, the inclusion of questions may force learners to interact with the

instruction "regardless of the need for such interaction" (p. 148). The inclusion of imposed questions may have conflicted with the individual schemata of some learners. In addition, although care was taken in phrasing the questions in a non-threatening way, they may also have introduced an unnecessary element of frustration within the review process which may have had a detrimental effect on some learners. More overt responses do not always result in greater learning (Bork, 1987; Blum-Cohen, 1984). The type of strategy that is required may vary depending on the type of learning outcome desired.

The finding that the addition of embedded questions did not affect the recall of procedures is consistent with a previous study with interactive video (Hannafin & Colamaio, 1988). Some differences between their study and the present one are worth mentioning. Hannafin and Colamaio were interested in the effect of practiced vs. non-practiced information. They used multiple-choice questions embedded throughout the lesson for practice and for their posttest. In spite of these differences they also found that the use of questions did not facilitate the recall of procedural information. A possible explanation was suggested by these authors which may be highly relevant to the present study.

> For procedural tasks, visual images are important aids in that they illustrate for the learner the succession of steps to be followed (Chu & Schramm, 1967). In effect, a form of vicarious mental rehearsal may occur during which appropriate visually oriented procedures can be modeled and consequences observed so that in some cases overt practice of the procedure is unnecessary. . . (Hannafin & Colamaio, 1988, p.230).

In this study, breaking the procedure into steps and providing visual reinforcement through the use of freeze frames and video sequences may have provided subjects with enough opportunities for mental rehearsal, therefore rendering the use of questions unnecessary.

The finding that review strategies did not significantly increase the recall of factual information is not consistent with previous research in interactive video. Previous studies concluded that the inclusion of practice questions is critical mostly for recall of factual information and problem-solving skills (Hannafin & Phillips, 1988; Hannafin & Colamaio, 1988; Hannafin, Phillips, & Tripp, 1986). Possible explanations may be found in the different use of questions and the nature of the testing procedures. In addition, examination of the means and standard deviations for facts (Table 4) shows a very small variability within treatments and fairly high means. This suggests a test ceiling effect which for this component would make the results difficult to interpret.

Previous research suggests that different types of learners benefit differently from interactive strategies. Scheffer and Hannafin (1986), for example, found a significant interaction between levels of interactivity and achievement. Schwier and Misanchuk (1988) also found that the use of embedded

questions was the more effective strategy only for learners with high need for training. However, no inferences can be made in this study regarding the characteristics of the learners since this variable was not taken into consideration. Further studies need to consider the interaction between learner characteristics and interactive strategies.

In conclusion, the question of interactivity must be examined more closely to take into account the quality of the strategy provided and how different types of strategies work depending on learners and desired learning outcomes. The contribution of this study to the research on instructional variables in interactive video is that it did not simply compare the presence vs. absence of practice questions, but also addressed alternative design strategies for promoting information processing and retrieval. The findings suggest that when teaching visual procedures using interactive video, simple recall post-questions are not an effective and efficient review strategy for recall of information. The most effective review strategy involves breaking the procedure into steps and providing visual reinforcement through the use of freeze frames and video sequences. The inclusion of questions and overt activities in the design of complex systems must be planned in terms of their impact on learning effectiveness and efficiency.

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ACKNOWLEDGEMENT: The author wishes to express her gratitude to Ms. Elaine Greenberg, Mr. David Hamond, Ms. Xiao-Han Hu and Ms. Miriam Posner for their assistance in carrying out this project.