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Advisor Use in CBT: Modality and Placement

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Abstract

Fifty-eight Education graduate students took a forty-minute computer-based instructional module on introductory statistics with a built-in solicited guidance mechanism. Subjects were randomly assigned to programs that used one of four types of advisement: on-screen digitized video of a human advisor, on-screen text-based advisor, pull-down digitized video of a human advisor, or pull-down text-based advisor. Results indicated that The on-screen video-based advisor condition resulted in higher advisor use than both the text-based and video-based pull-down advisor conditions. Advisor use was significantly correlated with performance during instruction, to time spent during instruction, and to television hours watched per week, but not with retention scores. Two nonsignificant, but inviting, findings were that the video-based on-screen advisors were used twice as much as text-based on-screen advisors and active learners used advisement three times as often as passive learners.

One of the more interesting practical questions involving the use of multimedia for instructional purposes concerns the best way to "coach" a student who needs additional help in understanding complex concepts. It is suggested by some researchers (e.g., Smith, 1992) that this coaching (or advisement) acts as an intermediate point between generative and supplantive instruction. This study investigated the use of an on-line advisor to assist students in learning statistical concepts via computer-based instruction.

The use of advisement in computer-mediated lessons has been well supported since microcomputers first came into use. Studies in the early 80s by Tennyson and his associates (Johansen & Tennyson, 1983; Tennyson, 1980; Tennyson & Buttrey, 1980) found that designing computer-based lessons using learner control with advisement increased performance when compared to lessons designed with either adaptive (program) control or learner control without advisement. In most cases, performance increase was accompanied by a decrease in total instructional time compared to adaptive control methods (Gray, 1988; Tennyson, 1980, 1981). Although some advisement strategies have been shown to be effective, getting students to use advisement has been problematic. Gay and Mazur, for example, presented data that a text-based, on-line advisor was not used very often (1993, p. 50). In the sense that an advisor "cues" the learner regarding important issues during instruction, the placement and ease of use of the advisor is an important concern.

There are various types of advisors available in technology-based instructional environments. These include and program-directed systems which may be guided by theoretical bases or probabilities and “intelligent” systems which track the learners navigational patterns and provide relevant chunks of information based on their on-task maneuvers. Likewise, there are learner-controlled advisers or guidance systems that are activated only upon the request of the user. Learners use advisors of both types for guidance about content issues or program navigation. A few authors (e.g., Zellerman, Salomon, Globerson, & Givon, 1991) have also distinguished between unsolicited guidance (assistance made available to or imposed on learners without request) and solicited guidance (assistance made available to learners only at their request). In essence, these approaches may be considered deductive or inductive respectively. A possible exception would be abductive or semiotic advisors set in a learning environment having attributes similar to a detective mystery or a diagnostic case study.

The limited number of programs that employ an advisor or coach frequently present the information in text. With more recent technological advances, use of audio and video advisors have become viable alternatives to text. Research concerning the use of video and audio advisors, however, has been limited or has had limited generalizability (Austin, 1994). In addition, although some attempts have been made to categorize the various categories of advisement in multimedia, a systematic typology of advisement has not been constructed. For instance, Santiago and Okey (1992) have established three categories of advisement: adaptive, evaluative, and directive. None of these categories, however, fit the advisement strategy used in several commercially-available instructional multimedia programs. For example, popular instructional CD-ROM program *Shoot Video Like a Pro* (1995), includes talking head "experts" to provide learners with tips to improve their emerging skills. The experts in this software are built into the camera-like interface, occupy a conspicuous location on the screen, are both male and female, and come from a variety of ethnic backgrounds. Essentially, these advisors “coach” by explaining a different perspective than the main flow of the program rather than adapting to, directing, or evaluating the learner’s performance.

Programs using video coaches fit well into a model for human-computer interaction proposed by Streitz (1988). In Streitz's model the learner is confronted with an interaction problem which requires the learner, as a user, to build a representation of the tutoring system. In addition to the "learner" and the "system," the model proposes a problem mediator and a human tutor. The human tutor reflects the fact that a person often does not learn strictly on his or her own initiative but because a person (boss, teacher, friend, etc.) proposes a learning path or alternate explanations. According to Streitz, this person functions as a problem mediator who makes suggestions or asks questions about specific content domains.

From another perspective, the video advisor functions as what the filmmaker Luis Bunuel refers to as the "explicador" (Bunuel, 1985; Plowman, 1994). During the early period of the cinema in Bunuel's native Saragossa, explicadors were used to explain the action of the movie to the audience and guide inexperienced moviegoers from scene to scene. In our time, the explicador is confined to a rectangular image of the medium closeup television image. Video advisors are a metaphor we can understand and accept. Television has trained us to do so. This understanding is what semioticians such as Solomon (1988) refer to as our "communal sense."

Educational research and theory regarding the use of video in computer-based environments is still in an early stage and, as with many other topics, the literature is inconclusive. In a study of inferencing strategies used by fifth grade students, Neuman (1992) found that both text and video elicited similar inferencing strategies. Conversely, Simonson, et al. (1985) found that realistic messages, such as those in video images, have a positive effect on learner attitudes in the direction of the intended message. A study by Barba and Armstrong (1992) suggested that low verbal students treated with interactive video performed statistically better than low verbal treated without the interactive video component. Kosma (1991), however, cautions that novices are more likely to fail at comprehending portions of video because their pace of processing information may be slower than the pace of the presentation of the video information.

Will learners actively seek out information required for knowledge or skill development? A science-related study using undergraduates conducted by Lee and Lehman (1993) found that instructional cues (hints to view embedded information) proved beneficial to subjects classified as passive learners and those classified as neutral (neither active nor passive). Active learners, by contrast, were unaffected by unsolicited instructional cues. Lee and Lehman also found that passive and neutral undergraduate learners who used the hypermedia program with instructional cues performed better than their counterparts who used the program without cues.

Given the assumption that an advisor is beneficial, where should it be located? At least for western cultures, research in both page design and screen design generally concurs that the left half of the screen or page has a strong influence on reader attention (Duin, 1988; Niekamp, 1981). Left placement has also been found to speed retrieval and improve readability (Hartley & Burnhill, 1976). It would make sense, therefore, to place an advisor (of whatever modality) on the left-side of the screen to maximize its effectiveness. At the same time, most researchers and interface designers agree that a computer screen should be less crowded even than its printed counterpart. Past research findings have maintained that text legibility is reduced on computer screens compared to printed materials (Kruk & Muter, 1984; Reubens & Krull, 1985). Although some of these research findings may have been confounded by comparing low-resolution displays to high-quality print (Bender, Crespo, Kennedy, & Oakley, 1987; Oborne & Holton, 1988), the dynamic nature of computer materials unquestionably imposes additional needs for parts of the screen to be dedicated to non-content materials (e.g., navigation bars). In other words, space is at a premium in computer-based materials.

Commercial applications software has responded overwhelmingly to the inherent space limitations of computer screens by the use of pull-down menus and commands. User-controlled menu bars are present in literally thousands of applications including those used most commonly such as word-processing programs. Educational research on the use of pull-down menus, however, is limited. One study by Schuerman and Peck (1991) suggests that the use of pull-down menus does not encourage learners to randomly access instructional components. Bolton and Peck (1991) found that learners, when presented with a single content screen, have a strong tendency to select items in the order listed in the menu.

Research Design

The purpose of this study was to explore the location of an advisor in the computer environment and the modality of the advisement mechanism in a computer-based module. Independent variables were the placement of the advisor (pull-down menu access to the advisor vs. an on-screen access) and the modality of the advisor (digitized video of a human advisor vs. a text-based advisor).

Dependent variables were the number of times the learner chose to use the advisor, retention test scores, and performance on practice items. Students' scores on the Computer Anxiety Ratings

Scale (Miller & Rainer, 1995) were used as a covariate. Time spent in instruction and learning style based on Lee & Lehman's Passive Active Learning Scale (1993) was collected for planned post-hoc analyses.

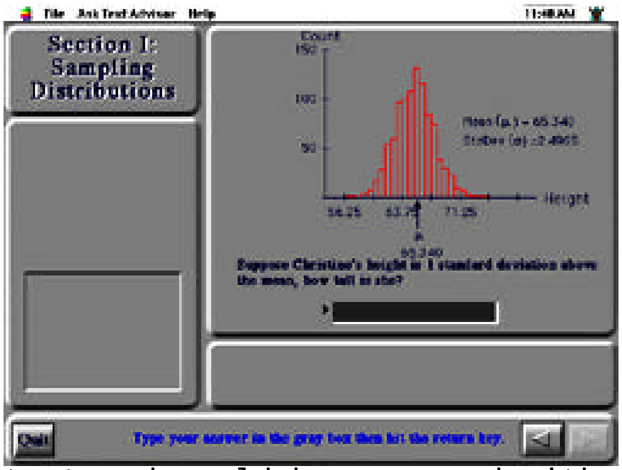
Our expectations were:
* The on-screen conditions would result in more frequent advisor use than the pull-down conditions.
* The video advisor would be used more frequently than the text advisor.
* Using an advisor would be positively correlated with performance during instruction and on the retention test.
* Learners who were classified as "passive" on the pals instrument would use advisement less than those classified as "active" in the pull-down conditions, but that this difference would decrease or be eliminated in the on-screen conditions.

Method

Subjects were 43 females and 15 males aged 21 through 57 years, with an average age of 35. Subjects were drawn from three graduate educational research survey courses and one graduate psychological principles of learning course at a southeastern university. Subjects had attended an average of 3.2 computer-related classes, had 4.9 years of computer experience, and watched television 11.3 hours per week. Subjects were randomly assigned to one of the four experimental conditions.

Materials

A forty-minute instructional module on statistics was developed using Macromedia Authorware. The lesson covered sampling distributions, hypothesis testing, and type I and II errors. The instruction employed a "rule-example-practice" format, and incorporated color, graphics, text, sound, and feedback. Based on the subject's assignment, advisement (solicited guidance) for each of the 25 practice items was available either as video or



text and could be accessed either on-screen or via a pull-down menu. In the video conditions, a male and female alternated as the advisor. The program was reviewed for content accuracy by two experienced educational researchers and was formatively evaluated. Screen shots of the four advisor conditions are shown in Figures 1 and 2.

Figure 1. Screen shot of the pulldown interface for both text and video conditions.

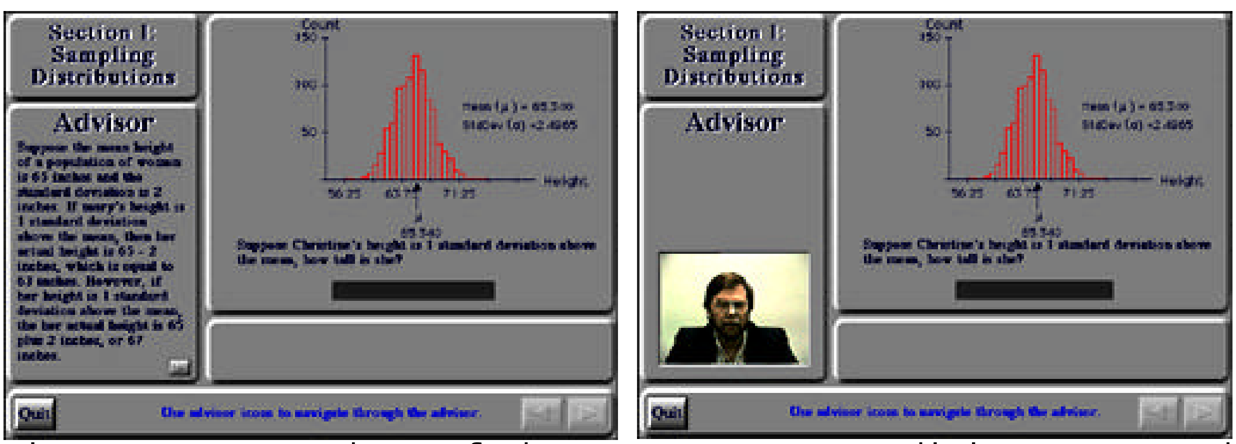


Figure 2. Screen shots of the two on-screen conditions: text and video.

Instruments

Student performance on practice items, time, and advisor use during instruction was tracked by the computer program.

Retention was assessed by means of an 18-item delayed posttest based on the content objectives for the statistical module. Items were validated by a content expert and were considered appropriate for the study. This multiple choice instrument had a Cronbach alpha score of .68 and a Guttman split-half reliability of .79.

Computer anxiety was measured by the 7-item Computer Anxiety Rating Scale (CARS) developed by Miller and Rainer (1995) from the original 19-item scale developed by Heinssen, Glass, and Knight (1987; see also Chu & Spires, 1991). This scale has been shown to reliably measure high and low anxiety constructs, with Cronbach alpha scores of .82 and .73 respectively.

Passive/Active learning style was measured by the 31-item Likert-type Passive Active Learning Scale (PALS) developed by Lee and Lehman (1993). Some of the items in the PALS scale were adapted from the deep processing and elaborative processing scales of the Inventory and Learning Processes (Schmeck, Ribich, & Ramanaiah, 1977). According to Lee and Lehman:

> Active learners were expected to actively select information on their own and demonstrate curiosity, initiative, and wide focus, among other learning characteristics. Passive learners were expected to select only information overtly provided and demonstrate indifference, dependence, and narrow focus, among other learning characteristics (1993, p. 28). This scale has been shown to reliably measure the passive/active learning construct, with a Cronbach alpha score of .81.

Procedure

A variety of demographic data including age, gender, computer classes attended, computer experience, TV hours watched per week, and graduate classes taken were collected prior to the instruction. At the same time, subjects completed the CARS anxiety measure. Subjects were randomly assigned to one the four treatment groups. The instructional materials were delivered during regularly scheduled class periods in a university computer laboratory equipped with computers, color monitors, and headphones. One week after instruction, the PALS instrument and the posttest were administered.

Results

A one-way ANOVA indicated significant differences in advisor use between groups (F=3.385, p=.025). Because Levene’s test for equality of variance was significant, estimated marginal means, which are not affected by unequal variances, were used for post-hoc analysis. The video-based on-screen advisor condition resulted in higher advisor use (EMM=5.25) than both the text-based (EMM=.866) and video-based (EMM=1) pull-down advisor conditions, but not the text-based on-screen condition, although it was used on average almost twice as much (EMM=2.384). Tables 1, 2, and 3 present these data in more detail.

Table 1. Mean advisor use by condition.

Text Hidden	Mean	.8667
	N	15
	SD	3.0907
	Median	.0000
Video Hidden	Mean	1.0000
	N	14
	SD	2.0755
	Median	.0000
Video Obvious	Mean	5.2500
	N	16
	SD	6.1264
	Median	3.0000
Text Obvious	Mean	2.3846
	N	13
	SD	4.7529
	Median	.0000
Total	Mean	2.4483
	N	58
	SD	4.6195
	Median	.0000

Table 2. ANOVA of advisor use by condition.

Dependent Variable: ADVUSE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Corrected Model	192.535[b]	3	64.178	3.385	.025	10.155	.734
Intercept	325.292	1	325.292	17.157	.000	17.157	.982
CONDITIO	192.535	3	64.178	3.385	.025	10.155	.734
Error	1023.810	54	18.959				
Total	1564.000	58					
Corrected Total	1216.345	57					

a. Computed using alpha = .05

b. R Squared = .158 (Adjusted R Squared = .112)

Table 3. Post-hoc tests of advisor use by condition.

Dependent Variable: ADVUSE

(I) CONDITIO	(J) CONDITIO	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Text Hidden	Video Hidden	-.1333	1.618	.935	-4.565	4.299
	Video Obvious	-4.3833*	1.565	.007	-8.670	-9.72E-02
	Text Obvious	-1.5179	1.650	.362	-6.037	3.001
Video Hidden	Video Obvious	-4.2500*	1.593	.010	-8.614	.114
	Text Obvious	-1.3846	1.677	.413	-5.978	3.209
	Text Hidden	.1333	1.618	.935	-4.299	4.565
Video Obvious	Video Hidden	4.2500*	1.593	.010	-.114	8.614
	Text Obvious	2.8654	1.626	.084	-1.588	7.318
	Text Hidden	4.3833*	1.565	.007	9.715E-02	8.670
Text Obvious	Video Hidden	1.3846	1.677	.413	-3.209	5.978
	Video Obvious	-2.8654	1.626	.084	-7.318	1.588
	Text Hidden	1.5179	1.650	.362	-3.001	6.037

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

Thirty-five, or sixty-percent, of all subjects did not use the advisor at all. There are no transformations available for a variable with this many zeros. Because advisor use has a low base rate to begin with (i.e., people do not seek or use advisement frequently), and because of the large proportion of zeros in the variable, the variable is positively skewed and bi-modal. This makes it hard to detect a difference using inferential statistics without very large sample sizes. Non-parametric statistics are not affected by skewed variables, and may be more likely to detect differences. For this reason, non-parametric statistics were run to examine differences among groups on advisor use. The results were identical to the parametric results.

Because of the large number of zeros, the advisor use variable was also converted to a categorical variable and analyzed via chi-square analysis. Thirty-five scores of zero were recoded as “none” for advisor use. The remaining 23 fell between 1 and 7, and 12 and 17. These scores were recoded as “some” advisor use. A chi-square analysis was then run with condition and the new advisor use variable (see table 4). The analysis indicated a significant deviation from expected values ($p = .002$). Analysis of adjusted standardized residuals indicated that the text-based pull-down advisor condition had more zero scores than would be expected by chance, and that the video-based on-screen advisor condition had fewer zero scores than would be expected by chance.

Table 4. Chi-square analysis of re-coded advisor use by condition.

			CONDITIO				
			Text Hidden	Video Hidden	Video Obvious	Text Obvious	Total
ADVCAT2	none	Count	13	11	4	7	35
		Expected Count	9.1	8.4	9.7	7.8	35.0
		% within ADVCAT2	37.1%	31.4%	11.4%	20.0%	100.0%
		% within CONDITIO	86.7%	78.6%	25.0%	53.8%	60.3%
		% of Total	22.4%	19.0%	6.9%	12.1%	60.3%
		Adjusted Residual	2.4	1.6	-3.4	-.5	
	some	Count	2	3	12	6	23
		Expected Count	5.9	5.6	6.3	5.2	23.0
		% within ADVCAT2	8.7%	13.0%	52.2%	26.1%	100.0%
		% within CONDITIO	13.3%	21.4%	75.0%	46.2%	39.7%
		% of Total	3.4%	5.2%	20.7%	10.3%	39.7%
		Adjusted Residual	-2.4	-1.6	3.4	.5	
Total		Count	15	14	16	13	58
		Expected Count	15.0	14.0	16.0	13.0	58.0
		% within ADVCAT2	25.9%	24.1%	27.6%	22.4%	100.0%
		% within CONDITIO	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	25.9%	24.1%	27.6%	22.4%	100.0%

Because of the nature of the advisor use variable, it may be more appropriate to look at descriptive statistics. Thirteen, or 37% of those who never selected advisement, were in the text pulldown condition. Eleven, or 31%, were in the video pulldown condition; seven, or 20%, were in the text on-screen condition; and four, or 11%, were in the video on-screen condition. In total, 68% of all those who never selected advisement were in the pulldown condition. Tables 5, 6, 7, and 8 below present these data in more detail.

Table 5. Frequencies of advisor use for text pulldown condition.

		Frequency	Percent
Valid	.00	13	86.7
	1.00	1	6.7
	12.00	1	6.7
	Total	15	100.0
Total		15	100.0

Table 6. Frequencies of advisor use for video pulldown condition.

		Frequency	Percent
Valid	.00	11	78.6
	3.00	1	7.1
	5.00	1	7.1
	6.00	1	7.1
	Total	14	100.0
Total		14	100.0

Table 7. Frequencies of advisor use for text on-screen condition.

		Frequency	Percent
Valid	.00	7	53.8
	1.00	2	15.4
	3.00	2	15.4
	6.00	1	7.7
	17.00	1	7.7
	Total	13	100.0
Total		13	100.0

Table 8. Frequencies of advisor use for video on-screen condition.

		Frequency	Percent
Valid	.00	4	25.0
	1.00	2	12.5
	2.00	1	6.3
	3.00	3	18.8
	4.00	1	6.3
	7.00	1	6.3
	14.00	2	12.5
	15.00	1	6.3
	17.00	1	6.3
	Total	16	100.0
Total		16	100.0

The relation between advisor use and performance was next analyzed. Pearson Product Moment Correlations indicated that advisor use was significantly related to performance during instruction (.407, $p<.01$) to time spent during instruction (.432, $p < .01$), and to television hours watched per week (.292, $p < .05$). Anxiety and computer classes were significantly related (.341, $p < .05$), as were performance during instruction and time spent during instruction (.427, $p < .01$) and performance during instruction and motivation (.462, $p < .01$). Performance during instruction was significantly related to posttest scores (.402, $p < .01$) and to motivation (.27, $p< .05$). Television hours watched was significantly related to computer experience (.283, $p < .05$). Table 9 presents these data in more detail.

Table 9. Correlations of variables.

Correlations

	Pearson Correlation									
	ADV. USE	AGE	ANXTY.	CMP _CLS	CMP _EXP	PERF. DUR. INST.	TIME	PALS _SCR	Reten- tion Test	TV HRS
ADVISOR USE	1.000	.051	.003	.013	-.070	.407**	.432**	.042	-.049	.292*
AGE	.051	1.000	-.050	-.250	.121	.235	.467**	.146	.035	.014
ANXIETY	.003	-.050	1.000	.341*	.124	.022	.073	.176	-.096	-.049
CMP_CLS	.013	-.250	.341*	1.000	.282*	.111	-.095	.099	.092	.022
CMP_EXP	-.070	.121	.124	.282*	1.000	-.107	-.004	-.003	.109	.283*
PERF. DUR. INST.	.407**	.235	.022	.111	-.107	1.000	.427**	.029	.402**	.192
TIME	.432**	.467**	.073	-.095	-.004	.427**	1.00	.024	.065	.074
PALS_SCR	.042	.146	.176	.099	-.003	.029	.024	1.000	-.146	-.173
POSTTEST	-.049	.035	-.096	.092	.109	.402**	.065	-.146	1.000	.144
TV_HOURS	.292*	.014	-.049	.022	.283*	.192	.074	-.173	.144	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Inferential statistics were next run to examine the relationship between passive/active/neutral learning style and advisor use. Active learners were defined as learners who scored one-half standard deviation above the mean PALS score; passive learners were defined as learners who scored one-half standard deviation below the mean. Neutral learners were defined as learners who scored between one-half standard deviation below to one-half standard deviation above the mean. Table 10 presents descriptive statistics for passive/active/neutral learner by condition on advisor use. A 3 X 4 ANOVA indicated there were no significant differences.

The four advisement conditions were then collapsed to yield a variable with two levels: on-screen and pulldown. A 2 X 3 ANOVA of passive/active/neutral learners and pulldown/on-screen condtions on advisor use was then run, and indicated that only the pulldown and on-screen conditions differed significantly. The inclusion of anxiety as a covariate yielded no different results.

Active learners used advisement almost three times as often as passive learners, but less than neutral learners. Neutral learners used advisement more than 3.5 times more than passive learners, and 1.25 more times than active learners (see table 10). As was indicated by the earlier ANOVA of passive/active/neutral learners by condition on advisor use, these differences were not significant, although there were several interesting findings.

Passive learners in the video on-screen condition used advisement 16 times more often than passive learners in the text on-screen condition. Passive learners in both the pulldown conditions never selected advisement.

Active learners in the video on-screen condition used advisement 3 times more often than active learners in the text on-screen condition and 28 times more often than active learners in the video pulldown condition. Active learners in the video pulldown condition did not select advisement.

Neutral learners in the video on-screen condition used advisement almost twice as often as neutral learners in the text on-screen condition, 3.5 times as often as neutral learners in the video pulldown condition, and 2.5 times as often as those in the text pulldown condition. Table 10 presents these data in more detail.

Table 10. Mean and standard deviations of passive/active/neutral learner by condition on advisor use.

	PALS_CAT	CONDITIO	Mean	Std. Deviation	N
ADVUSE	Active Learners	text pulldown	.1667	.4082	6
		video pulldown	.0000	.	1
		video on-screen	4.6667	6.5765	9
		text on-screen	1.5000	2.1213	2
		Total	2.5556	5.0553	18
	Passive Learners	text pulldown	.0000	.0000	4
		video pulldown	.0000	.0000	5
		video on-screen	5.5000	2.1213	2
		text on-screen	.3333	.5774	3
		Total	.8571	2.0702	14
	Neutral Learners	text pulldown	2.4000	5.3666	5
		video pulldown	1.7500	2.5495	8
		video on-screen	6.2000	7.1554	5
		text on-screen	3.3750	5.9025	8
		Total	3.2308	5.1947	26
	Total	text pulldown	.8667	3.0907	15
		video pulldown	1.0000	2.0755	14
		video on-screen	5.2500	6.1264	16
		text on-screen	2.3846	4.7529	13
		Total	2.4483	4.6195	58

Active learners also spent an average of more than 5 minutes longer in the instruction than passive learners. An ANOVA of Time spent by PALS condition indicated that this difference was significant (F=3.525, p=.036). Differences between neutral learners and passive or active learners were not significant.

Descriptives

	PALS_CAT		Statistic	Std. Error
MINUTES	Passive Learners	Mean	29.21	1.19
		Std. Deviation	4.44	
	Active Learners	Mean	34.44	1.19
		Std. Deviation	5.07	
	Neutral Learners	Mean	31.31	1.35
		Std. Deviation	6.90	

Discussion

Advisement performs two important functions according to Hannafin, et al. It can augment or supplant metacognitive processing. As an augmenting function, it can be used as a kind of “second opinion.” As a supplanting resource, it can lessen the cognitive burden associated with self-regulated learning (1996, p. 387; see also Hannafin, Hall, Land, & Hill, 1994). Although other researchers have suggested additional functions (e.g., Streitz, 1988), augmenting and supplanting describe well the roles of all the types of advisors used in this study. Of consequence in the discussion of this study is the fact that the advisement, when it was used, was solicited by the learner. Where unsolicited advisement is deductive and designer-controlled, solicited advisement is inductive and user-controlled. Thus all the data collected in this study was in a natural context, based on the choices made by users. That 35 of the 58 learners in this study did not use advisement at all, comes as no real surprise.

It does, however, make inferential analysis of the data a difficult proposition. A colleague of ours likened this study of solicited advisors to an epidemiological study where the zeros are often the most common scores and very large numbers of subjects are needed to use inferential statistics effectively (J. Van Haneghan , personal communication, March 17, 1998). In interpreting the findings of the present study, therefore, we hope that readers will consider the trends conspicuous in the descriptive statistics as well as the outcomes of significance tests.

Our first expectation, that the on-screen conditions would result in more frequent advisor use than the pull-down conditions, was partially supported. Subjects who had on-screen access to an advisor used advisement more than four times as often on average than those who had pull-down access to an advisor (3.965 vs. .931). Figure 3 shows data that illustrate partial support for the main effect of advisor placement. The on-screen video condition was statistically different from both pull-down conditions. The on-screen text condition, although higher than both pull-down conditions, was not statistically different. The mean advisor use for the video-based, on-screen condition, although more than twice that of the text-based, on-screen advisor group, was not significant. This may be partially explained by the high number of zeros in the advisor use variable, the vast majority of which are located in the pull-down conditions. Likewise, our second expectation, that the video advisor would be used more frequently than the text advisor was not supported. Although the mean advisor use for the video conditions was higher than those for the text conditions, the differences were not statistically significant.

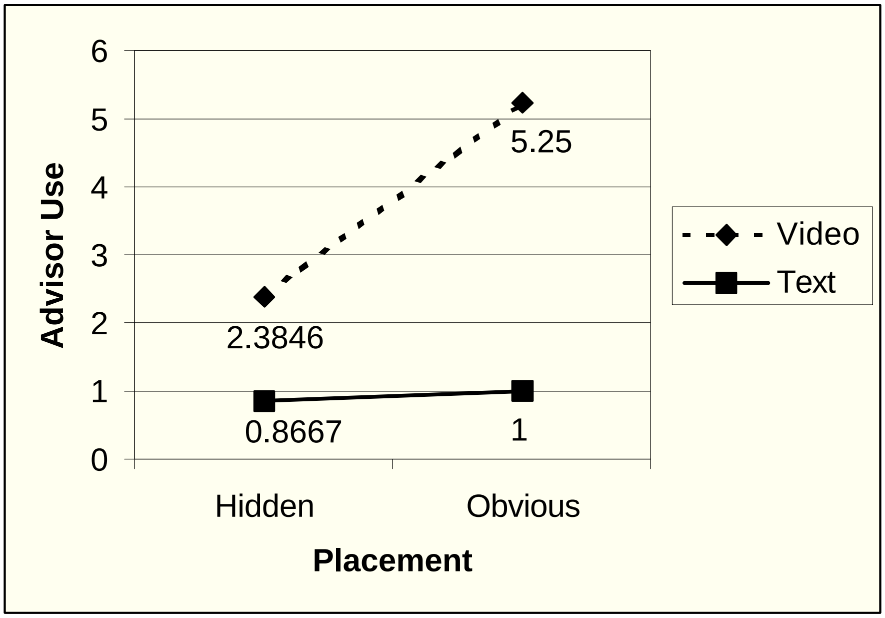


Figure 3. Mean advisor use by modality and placement

One way to view these findings is to consider the video on-screen advisor as that which most closely approximating what Kosma (1994) refers to as a “creative interaction” or Schon (1987) refers to as “conversation” between the designer, the situation, and the medium in which the design both shapes and is shaped by each of these factors. In preparing a solicited advisor, particularly one that focuses on content rather than navigation, the designer is offering to aid the learner, but not dictating that this offer be accepted. One potential benefit of the “talking head” advisor placed strategically on-screen is that the “conversation” with the user is in a more naturally appearing context.

In Isaac Asimov’s famous science fiction Foundation trilogy (1952), the astute Harry Seldon character, a psychohistorian long since dead, uses earlier-recorded videos, delivered at predetermined intervals, to proffer advice to future leaders of the Foundation. Naturally, Seldon's advisement caused much interest and speculation among its users. We've seen this vehicle for advisement used often in our popular culture. Witness the visitations of Obi-Wan Kenobi in Lucas' Star Wars movies. Although introductory statistics is a far less interesting topic than the future of an entire civilization, it is our interpretation that the on-screen use of the video advisor stimulated more interest than the other conditions and therefore was a better communication tool.

Although all subjects were introduced to the mechanics of the method of advisement to which they were assigned, the pull-down conditions unquestionably were ineffectual in this study. Approximately four-fifths of the subjects in the pull-down conditions never selected advisement. Clearly, the placement of the advisement is consequential. Pull-downs may be omnipresent as functional menus in application programs and on-line help systems, but the findings of this study suggest that they are less desirable in computer-based training. This finding is consistent with some studies in the human-computer interaction literature which suggest the existence of on-line help (usually in the form of a pull-down) is a distraction from the task (Relles, 1979; Shneiderman, 1980) and has an adverse effect on user performance particularly for novices (Dunsmore, 1980; Cohill & Williges, 1982).

Our third expectation, that advisor use would be significantly correlated with performance during instruction and for the retention test, was partially supported (see table 9). Advisor use was significantly correlated with performance during instruction but not with retention. Because performance during instruction and retention scores were significantly correlated, the researchers concluded that the tests are reliable. The failure of advisor use to make a difference in retention might be because the advisement was not effective enough to make long-term gains significant. Also, subjects were aware that their performance was not graded and that their professor would not know their performance results. It is likely that subjects did not engage in any outside rehearsal or practice of the relevant information as would normally be the case when a test affects a course grade.

A related finding was that time on-task was correlated with both advisor use and performance during instruction. This finding would suggest that advisement may help learners to engage in more substantive involvement with the instructional materials. From a Vygotskian (1978) perspective, this substantive interaction with the advisor or coach is important first of all because the control is in the hands of the individual who has chosen to accept the advisement. Secondly, particularly in the case of the “explicador” (Plowman, 1994) advisor model, the designer has an exceptional opportunity to link the learner’s prior knowledge to new knowledge through a simulated social interaction with a “knowledgeable other” (Peters, 1996; Scott, Cole, & Engel, 1992) . If the advisor is well constructed, the extra time spent in using advisement can become a valuable social and cognitive mechanism for both the learner and the instructional designer.

Finally, we expected that passive learners would use advisement less than active learners, and that this difference would be reduced or eliminated in the on-screen advisement conditions. Although not statistically significant, passive learners did use the advisor less in all conditions but the video on-screen condition although given the small numbers of subjects, these differences could well be due to chance. Even so, the data presented in this study point to the possibility that on-screen video advisors could be an effective tool to engage passive learners.

References

Asimov, Isaac (1952). Foundation and empire. Garden City, NY: Doubleday and Company.

Austin, M.B. (1994). A comparison of three interactive media formats in an RTV/DVI computer-mediated lesson. Computers in Education, 22 (4), 319-333.

Barba, R.H., & Armstrong, B.E. (1992). The effect of HyperCard and interactive video instruction on earth and science student's achievement. Journal of Educational Multimedia and Hypermedia, 1, 341-354.

Bender, W, Crespo, R.A., Kennedy, P.J., and Oakley, R. (1987). CRT typeface design and evaluation, Proceedings of the Human Factors Society Thirty-First Annual Meeting, 1311-1314.

Bolton, J.W., & Peck, K.L. (1991). Menu sequence, learner control, and achievement in CAI. Interactive Learning International, 7, 95-100.

Bunuel, L. (1985). My last breath. London: Fontana.

Cohill, J.M., & Williges, R. C. (1982).Computer-augmented retrieval of HELP information for novice users. Proceedings of the Human Factors Society Twenty-Sixth Annual Meeting, 79-82.

Chu, P.C., & Spires, E.E. (1991). Validating the computer anxiety rating scale: Effects of cognitive style and computer courses on computer anxiety. Computers in Human Behavior, 7, 7-21.

Duin, A.H. (1988).Computer-assisted instructional displays: Effects on students' computing behaviors, prewriting, and attitudes. Journal of Computer-Based Instruction, 15 (2), 48-56.

Dunsmore, H.E. (1980). Designing an interactive facility for non-programmers. Proceedings of the ACM national Conference, 475-483.

Gay, G., & Mazur, J. (1993) The utility of computer tracking tools for user-centered design. Educational Technology (Research Section), 33 (4), 45-59.

Gray, D.M. (1988). The use and effect on performance of learner control and advisement in a computer-based educational statistics lesson. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.

Hannafin, M.J., Hannafin, K.M., Hooper, S.R., Rieber, L.P., & Kini, A.S. (1996). Research on and research with emerging technologies. In D.H. Jonassen (Ed.). Handbook of research for educational communications and technology. New York: Simon & Schuster MacMillian.

Hannafin, M.J., Hall, C., Land, S., & Hill, J. (1994). Learning in open-ended environments; Assumptions, methods, and implications. Educational Technology, 34 (8), 48-55.

Hartley, J., & Burnhill, P. (1976). Explorations in space: A critique of the typography of BPS publications, Bulletin of the British Psychological Society, 29, 97-107.

Heissen, R.K., Glass, C.R., & Knight, L.S. (1987) Assessing computer anxiety: Development and validation of the computer anxiety rating scale. Computers in Human Behavior. 3, 49-59.

Johansen, K.J., & Tennyson, R.D. (1983). Effect of adaptive advisement on perception in learner-controlled, computer-based instruction using a rule-learning task. Educational Communications and Technology Journal, 31 (4), 226-236.

Kosma, R.B. (1991). Learning with media. Review of Educational Research, 61 (2), 179-211.

Kosma, R.B. (1994). Will media influence learning? Reframing the debate. Educational Technology Research & Development, 42 (2), 7-19.

Kruk, R.S., & Muter, P. (1984). Reading of continuous text on video screen. Human Factors, 26, 339-345.

Lee, Y.B., & Lehman, J.D. (1993). Instructional cueing in hypermedia: A study with active and passive learners. Journal of Educational Multimedia and Hypermedia, 2 (10), 25-37.

Miller, M.D., & Rainer, R.K. (1995). Assessing and improving the dimensionality of the computer anxiety scale. Educational and

Psychological Measurement, 55 (4), 652-657.

Neicamp, W. (1981). An exploratory investigation in factors affecting visual balance. Educational Communication and Technology Journal, 29, 37-48.

Neuman, S.B. (1992). Is learning from multimedia distinctive? Examining children's inferencing strategies. American Educational Research Journal, 29, 119-140.

Oborne, D.J. & Holton, D. (1988) Reading from the screen versus paper: There is no difference. International Journal of Man-Machine Studies, 28, 1-9.

Peters, J.M. (1996). Vygotsky in the future: Technology as a mediation tool for literacy instruction. In L. Dixon-Krauss (ed.). Vygotsky in the classroom: Mediated literacy instruction and assessment. White Plains, NY: Longman Publishers.

Plowman, L. (1994). The "primitive mode of representation" and the evolution of interactive multimedia. Journal of Educational Multimedia and Hypermedia, 3 (3/4), 275-293.

Relles, N. (1979). The design and implementation of user-oriented systems. Unpublished doctoral dissertation, University of Wisconsin, Madison, WI.

Rubens, P., & Krull, R. (1985). Application of research on document design to on-line displays. Technical Communication, 32, 29-34.

Santiago, R.S., & Okey, J.R. (1992). The effects of advisement and locus of control on achievement in learner-controlled instruction. Journal of Computer-Based Instruction, 19 (2), 47-53.

Schon, D. (1987). Educating the reflective practitioner. San Francisco: Josey-Bass.

Schmeck, R.R., Ribich, F., & Ramanaiah, N. (1977). Development of a self-report inventory for assessing individual differences in learning process. Applied Psychological Measurement, 1, 413-431.

Schuerman, R. L., & Peck, K. L. (1991). Pull-down menus, menu design, and usage patterns in computer-assisted instruction. Journal of Computer-Based Instruction, 18 (3), 93-98.

Scott, T., Cole, M., & Engle, M. (1992). Computers and education: A cultural constructivists perspective. In G. Grant (ed.), Review of research in education, Vol. 18, pp. 191-251.

Shneiderman, B. (1980). Software psychology: Human factors in computer and information systems. Cambridge, MA: Winthrop Publishers, Incorporated.

Shoot Video Like a Pro [Computer Software]. (1995). Pleasanton, CA: Red Hill Studios.

Simonson, M.R., Aegerter, R., Berry, T., Klock, T., & Stone, R. (1985, February). Persuasion: Five studies dealing with the relationships between media, attitudes, and learning style. Paper presented at the annual meeting of the Association for Educational Communications and Technology, Anaheim, CA.

Smith, P.L. (1992, April). A Model for Selecting from Supplantive and Generative Instructional Strategies for Problem-Solving Instruction. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Solomon, J. (1988). The signs of our time. Los Angles, CA: Jeremy P. Archer, Inc.

Streitz, N.A. (1988). Mental models and metaphors: Implications for the design of adaptive user-system interfaces. In H.Mandl & A. Lesgold (Eds.). Learning Issues for Intelligent Tutoring Systems (pp. 164-186). New York: Springer-Verlag.

Tennyson, R.D. (1980). Instructional control strategies and content structure as design variables in concept acquisition using computer-based instruction. Journal of Educational Psychology, 72 (4), 525-532.

Tennyson, R.D. (1981). Use of adaptive information for advisement in learning concepts and rules using computer-assisted instruction. American Educational Research Journal, 4, 425-438.

Tennyson, R.D., & Buttrey, T. (1980). Advisement and management strategies as design variables in computer-assisted instruction. Educational Communications and Technology, 28, 169-176.

Vygotsky, L.S. (1978). Mind in society: The development of higher psychological processes. (M. Cole, V. John-Steiner, S.Scribner, and E. Souberman, eds.). Cambridge, MA: Harvard University Press.

Zellerman, M., Salomon, G., Globerson, T., & Gion, H. (1991). Enhancing writing-related metacognitions through a computerized writing partner. American Educational Research Journal, 28 (2), 373-391.

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