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ABSTRACT

The purpose of this study was to determine if increasing levels of complexity in visual production techniques would increase the viewer's learning comprehension and the degree of likeness expressed for a college level instructional television program. A total of 119 mass communications students at the University of Alabama participated in the study. There was no significant difference found in the level of learning comprehension or the degree of likeness between the experimental groups that saw the basic version (cuts-only editing, on-camera graphics, and simple computer character generation), the advanced version (basic version plus dissolves, fades, and computer generated static graphics), and the extravagant version (advanced version plus digital video compression, digital video expansion, and computer generated moving graphics) of the same instructional television program. These results lead to two conclusions: (1) instructional television producers may utilize complex visual production techniques when appropriate without fearing any negative effects on learning; and (2) organizations need not spend hundreds of thousands of dollars for television equipment when equipment costing only tens of thousands of dollars will produce the same educational results. Data are presented in nine tables. (Contains 53 references.) (Author/ALF)

Instructional Television:

Visual Production Techniques and Learning Comprehension

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Abstract

The purpose of this study was to determine if increasing levels of complexity in visual production techniques would increase the viewer's learning comprehension and the degree of likeness expressed for a college level instructional television program. There was no significant difference found in the level of learning comprehension or the degree of likeness between the experimental groups which saw the basic version (cuts-only editing, on-camera graphics, and simple computer character generation), the advanced version (basic version plus dissolves, fades, and computer generated static graphics), and the extravagant version (advanced version plus digital video compression, digital video expansion, and computer generated moving graphics) of the same instructional television program. These results lead to two conclusions: (a) instructional television producers may utilize complex visual production techniques when appropriate without fearing any negative effects on learning, and (b) organizations need not spend hundreds of thousands of dollars for television equipment when equipment costing only tens of thousands of dollars will produce the same educational results.

Instructional Television:
Visual Production Techniques and Learning Comprehension

For more than 25 years, the general public has been conditioned to believe that television is an entertainment medium (Spears, 1991; Stedronsky, 1987; Travers, 1964). But television is being used increasingly to deliver college level instructional programming and herein lies a serious problem for the creators of instructional television (ITV). Entertaining and attention getting visual production techniques such as dissolves, wipes and digital video effects have found their way into ITV programs from music videos, sporting events, and news broadcasts. There has been, however, almost no empirical evidence to justify their use. Morris (1984), Utz (1980), and Zettl (1976) assert that the writers of television programs believe that the application of certain production techniques could possibly increase the level of attention paid to a program. This theory has now advanced one step further by entering the realm of instructional and educational programs where it is believed that increasing the attention paid to a program might lead to increased achievement (Bronfenbrenner, 1976; Chu & Schramm, 1976; Hosie, 1987; Morris, 1984). But can these higher levels of

visual production techniques actually lead to an increase in viewer learning comprehension?

This question of entertainment versus instruction poses a serious dilemma for the producers of ITV programs. Should producers give their viewers what they want with complex visual production techniques, or simply what viewers need with simple visual production techniques?

Ball, Palmer, & Millward (1976) found that programs that are designed to teach and entertain can be successful in developing a young child's skill in particular subject areas. These programs are made more entertaining and attractive through the use of visual production techniques, which producers have relied on to maintain the attention of the viewer (Brock & Goldstein, 1985). However, Johnson & Ettema (1986) found that "devices and tricks to hold attention may be important, but they are insufficient to lead to comprehension" (p. 157).

Still, these high levels of visual production techniques are being used in ITV programs with the hope that greater attention will lead to greater learning comprehension. At least one major provider of educational and instructional media is convinced that this is the case. The National Geographic Society has

determined that their interactive materials should be as dynamic, intriguing, and lively as music videos, movies, and computer games (Peterson, 1990). But interactive learning is much different from the traditional one-way source-receiver ITV program.

Review of Literature

A search utilizing typical communications reference materials has yielded few direct empirical studies in which visual production techniques were varied while measuring learning comprehension. As Clarke (1974) and Walker (1987) discovered, most media research tends to concentrate on specific program types and features (i.e., violence, sex, stereotypes, communicator credibility, attention to the message, attractiveness, and importance), not on the program itself.

Most studies focus on specific production elements such as color versus black and white. It was found that color, although appealing to the aesthetic senses, produced no significant gain in either immediate or retained learning or in the amount learned (Dwyer, 1971; Johnson & Roberson, 1970; Kanner & Rosenstein, 1960; Katzman & Nyenhuis, 1972; Rosenstein & Kanner, 1961; Rudisill, 1952; Scanlon, 1970; VanderMeer, 1952). Although color was more common in both film and

television by the time some of these studies were completed, the primary value of using color was in its entertaining ability.

When film optical effects (i.e., dissolves, fades, and wipes) were studied, Mercer (1952) found that these effects did not aid in factual learning. Studies have even gone so far as to determine the effect of camera and lighting angles on source judgment and attraction. McCain, Chilberg, & Wakshlag (1977) found that a high camera angle (i.e., 46 inches above while 12 feet away) produced the highest credibility and attraction ratings by college students, while Tannenbaum & Fosdick (1960) found that a 45 degree key light to camera-subject axis produced the highest judgment ratings.

With all of these production-specific studies it is important to remember that a television program is more than just individual shots or sounds working independently of one another. Gestalt psychologists argue that the whole is larger than the simple sum of its parts (Eisenstein, 1957; McCain et al., 1977; Tannenbaum & Fosdick, 1960), but there are still too few studies that look at the production itself as well as its educational goals.

While studies have been made which concern visual production techniques in children's educational

programs (such as Sesame Street), only a few studies concern themselves with the college level ITV program. Morris (1984) produced two different versions of the same college lecture on videotape to discover if innovative production techniques such as "pop-in" animation, moving diagrams, high contrast graphics, scenarios, and contemporary music, when used with an instructor, have a better effect on student achievement than the standard "talking head" instructor with chalkboard. It was found that graphics and "pop-in" animation alone do not significantly improve immediate achievement, but that students' attitudes about the program itself do improve, since it is more entertaining. Moreover, on-location vignettes, freeze frames, animated moving graphics, and music were found to significantly improve immediate and delayed achievement but only on questions designed to specifically measure conceptual understanding of the information provided within the videotape program. Morris (1984) suggests that the favorable reaction to the higher levels of visual production is alone justification for their use.

Guidelines for Production

Ellis & Thornborough (1923) wrote the first comprehensive work on the uses of motion pictures in

education. Since then, more and more manuals have been published. While most of these publications mention the importance of gaining and maintaining student attention, they do not discuss how attention can be transferred to learning (Cohen, 1978; Creswell, 1986; Durantine, 1989; Hirschen, 1987; Hosie, 1987; Ivey, 1988; Kemp & Dayton, 1985; Rifkin, 1988; Schleger, 1987; Seibert & Honig, 1960; Shimizu, 1989; Wood & Wylie, 1977). Hunter (1990) however, suggests that attention be used as a natural motivator leading to learning.

In determining how the instructional message is received from a behavioral sciences viewpoint, Fleming & Levie (1978) placed strong emphasis on gaining the viewers' attention, but even stronger emphasis on how much or how little needs to be done to maintain that attention. Travers (1984) mirrors this sentiment by calling for research into the level and limits of optical stimulation on adding interest to learning.

Since empirical evidence was somewhat scarce, publications dealing with basic television production were consulted. Although none deal directly with ITV, these books offer useful informational points regarding production techniques that have been shown to distract from the content of a program. Millerson (1985) lists

18 specific production techniques that should be avoided because they may be too confusing and frustrating to the viewer, thus taking away from content and comprehension.

While researching methods to test the effectiveness of specific visual production techniques for ITV, Cobin & McIntyre (1961) found that those in charge of ITV productions were answering their questions with intuition rather than empirical evidence. This was restated in a report on audiovisual information transmission in which Travers (1964) found that most program producers were not aware of the theories involved in transmitting information to bring about learning and that their approach was totally intuitive. Ettema (1980) suggested that researchers and educators should serve as advisers to the production staff so that the content of the program and not the program itself remains the primary focus. Research by DeGraff (1985) explained that instructional researchers and designers think of ITV as a form of education, while television program directors think of ITV as a production.

Perhaps the simplest explanation for the use of visual production techniques was given by Wagner (1953). In an analysis of educational films, he

determined that these techniques should be used the same way that punctuation is used in writing, as an end to a statement, a pause, or an exclamation.

Hypothesis

For the ITV producer, having to decide whether complex visual production techniques will maintain attention and lead to increased learning comprehension is a complex problem. This decision is further complicated when a complex visual production technique might backfire and distract from learning by overloading the finite resources of the human information processing system (Broadbent, 1982; Kahneman, 1973; Lang, Strickwerda, Sumner, Winters, & Reeves, 1991), or distract from aurally transmitted information (Lang et al., 1991). The problem of possible effects was stated best by Bates (1981) who found that "the difficulty for broadcasters is that the technology separates the producer from the user of the product" (p. 113).

This study will investigate the effects of different levels of visual production techniques in a college level ITV program on viewers' learning comprehension and degree of likeness expressed for the program. Based on the research, literature, and

intuitive nature of producers of ITV programs, the following hypotheses are formulated:

H1: As the level of complexity of visual production techniques increases in a college level ITV program, the amount of learning comprehension of the viewer will increase; and

H2: As the level of complexity of visual production techniques increases in a college level ITV program, the degree of likeness expressed by the viewer for the program will increase.

Both of these hypotheses make use of the attention getting and entertaining properties of complex visual production techniques.

Method

Subjects

One hundred and sixty undergraduate college students were randomly recruited from two "Introduction to Mass Communications" classes at The University of Alabama. Students (subjects) were told that they would be volunteering for research and that four sessions, limited to 40 participants each, were available. Subjects could choose the day (Tuesday or Thursday) and the time (6:00 p.m. or 7:30 p.m.) of their choice for the following week. Potential subjects were told that they would be watching television and then answering a

test questionnaire, and that each session would last less than 60 minutes. The purpose of the study was not revealed. A total of 119 subjects actually participated in the study.

Materials

To limit prior knowledge of the subject matter of the program, the video chosen was The Wall Street Journal Video Guide to Money & Markets (Dow Jones, 1990), a 30 minute instructional video program dealing with topics such as stocks, bonds, the federal reserve bank, the foreign exchange market, and the futures/commodities markets.

For this study, basic visual production techniques consisted of cuts-only editing, on-camera graphics, and simple computer character generation. Advanced visual production techniques consisted of dissolves, fades, and computer generated static graphics. The advanced version could also incorporate techniques used in the basic version. Extravagant visual production techniques consisted of digital video compression, digital video expansion, and computer generated moving graphics. The extravagant version could also incorporate techniques used in both the basic and advanced versions.

Editing Conventions. All three versions of the program originated from the same distribution copy of the videocassette. Each version was re-edited while maintaining the same level of video and audio quality so as not to interfere with the content of the program or the program's sensory appeal, as recommended by Hackman & Walker (1990).

The definitions for "basic", "advanced", and "extravagant" visual production techniques are derived from the three standard ways that videotape can be edited. A simple "cuts-only" single-source editing system was considered to produce a "basic" product. A two-machine (two-source) "A-B roll" editing system incorporating a production switcher for transitional elements was considered to produce an "advanced" product. A two-machine (two-source) "A-B roll" editing system incorporating a production switcher which utilized digital video effects for image manipulation for transitional elements was considered to produce an "extravagant" product.

Design and Procedure

During each session, the subjects viewed either one version of the program (group 1, basic visual production techniques; group 2, advanced visual production techniques; or group 3, extravagant visual

production techniques) or an instructional television program of the same length and style but dealing with a different subject matter (group 4, control). A control group was used to determine if learning occurred within the experimental groups. Each videotape was randomly assigned to its session. A pretest was not used to avoid any prior knowledge of what would be asked on the test questionnaire.

Immediately after viewing the program, all groups completed a test questionnaire.

Test questionnaire. A test questionnaire was developed with the aid of a member of the faculty of the Economics, Finance, and Legal Studies Department of the Manderson Graduate School of Business at the University of Alabama. The questionnaire was designed to test the viewers' immediate comprehension of the program through 40 objective-type, multiple-choice questions, with five possible answers for each question. Also included in the test questionnaire was a degree of likeness question (five-point rating scale) and three background questions designed to determine if a great amount of prior knowledge about the subject matter exists. The final version of the test questionnaire was pilot tested with a group of six graduate students from the University of Alabama's

Department of Telecommunication and Film to reveal any problems arising from word choice or question flow. Only minor modifications were made to the test questionnaire as a result of the pilot test.

The results of the test questionnaire were used to determine if the different levels of visual production techniques had any effect on learning comprehension and degree of likeness as specified by the hypotheses.

Results

Statistical analysis was conducted using SAS version 5.18, as developed by the SAS Institute of Cary, North Carolina. The University of Alabama's IBM 3090 Mainframe computer was used to run the package.

In initial analysis of the general characteristics of the experimental groups, no significant difference with regard to possible prior knowledge of the material in the test videotape was found, as is shown in Table 1. In addition, no significant difference was found when comparing education grade level among all four groups, as shown in Table 2.

Learning Comprehension

The first stage of data analysis was to determine if any significant difference occurred in the test questionnaire scores of the three experimental groups. A one-way analysis of variance (ANOVA) indicated no

significant difference between any of the experimental conditions with a level of significance set at 0.05, as shown in Table 3. To verify that learning did occur within the experimental groups, a one-way ANOVA was conducted using all four groups (three experimental and one control). A significant difference, $F(3, 115) = 16.99$, $p<.0001$, was found when the control group was added to the one-way ANOVA with a level of significance set at 0.05, as shown in Table 4.

To further test the effects of visual production techniques, a series of t-tests were performed. In a study of the effects of related and unrelated cuts on viewer's memory for television, Lang et al., (1991) tested information occurring within about two seconds of the cuts under investigation. Using this as a guide, a four second time period was selected for testing, since the application of some of the visual production techniques had a duration approaching two seconds. This meant that information had to be presented within four seconds after the completion of a visual production technique. Three separate t-tests were conducted.

The first t-test compared the seven questions whose information was presented within four seconds after the completion of either an advanced visual

production technique (group 2) or an extravagant visual production technique (group 3), depending on which tape was viewed. As shown in Table 5, there was no significant difference between subjects that viewed the advanced tape (group 2) and subjects that viewed the extravagant tape (group 3) with regard to questions testing information presented within four seconds after the completion of an advanced versus an extravagant visual production technique, with a level of significance set at 0.05.

The second t-test compared the nine questions whose information was presented within four seconds after the completion of either a basic visual production technique (group 1) or an advanced visual production technique (group 2), depending upon which tape was viewed. As shown in Table 6, there was no significant difference between subjects that viewed the basic tape (group 1) and subjects that viewed the advanced tape (group 2) with regard to questions testing information presented within four seconds after the completion of a basic versus an advanced visual production technique, with a level of significance set at 0.05.

The third t-test compared the 16 questions whose information was presented within four seconds after the

completion of either a basic visual production technique (group 1) or an extravagant visual production technique (group 3), depending upon which tape was viewed. As shown in Table 7, there was no significant difference between subjects that viewed the basic tape (group 1) and subjects that viewed the extravagant tape (group 3) with regard to questions testing information presented within four seconds after the completion of a basic versus an extravagant visual production technique, with a level of significance set at 0.05.

Degree of Likeness

Experimental condition subjects were asked to rate their degree of likeness towards the videotape viewed. The choices available were (in order) "liked very much", "liked", "neutral", "disliked", and "disliked very much". These choices were converted into their answer number equivalents (one through five respectively, with a higher number indicating a more negative response) for analysis. A one-way ANOVA showed no significant difference in the degree of likeness between the different visual production technique videotapes, as shown in Table 8.

Discussion

The results of this study indicate that different levels of complexity of visual production techniques in

ITV programs have no significant effect on the amount of learning comprehension of the viewer or on the degree f likeness expressed by the viewer for the ITV program. These results do not support the theory that complex visual production techniques will lead to an increase in learning.

When measuring the degree of likeness expressed by subjects for a particular ITV program, one must keep in mind that "liking" is a relative emotion. Subjects did not have another program to use as a comparative guide. Therefore, as would be expected, the degree of likeness for the program viewed revolved around neutral, as shown in Table 9.

Further Study

The results obtained must be evaluated within the limitations of the study. What effect did student volunteers have from students whose class grade is partially based on the material presented in an ITV program? Obviously, classroom students have more motivation to do well than volunteer students do.

Additionally, measures of entertainment value and attention paid to complex visual production techniques were beyond the scope of this work. Does entertainment and/or attention lead to increased learning when students are exposed to the same complex visual

production techniques outside the classroom? It is easy to see that further studies along this line are needed.

Implications for Producers

The term "producers" not only means the person or persons who are responsible for producing the ITV program itself, but the organizations that sponsor such programs. In these hard economic times, does an ITV producer need the latest or "jazziest" equipment to produce an effective ITV program? This study suggests that the answer is "no." Without the complex "bells and whistles", an argument might be made that the messages presented would be clearer. This study, however, does not support that claim either.

Instead, this study does support that the use of complex visual production techniques has no effect on learning, so producers should feel free to use them when appropriate. ITV programs can be flashy, but they will not be better from an education perspective. Indeed, organizations need not spend hundreds of thousands of dollars for equipment, when less expensive alternatives costing only tens of thousands of dollars produce the same educational results.

One warning of which most ITV producers need to be aware: "The Look" of an ITV program is sometimes the

strongest criteria used in evaluating ITV programs. Without complex visual production techniques, an ITV program might look boring and dull. What is proper must be weighted against what is expected in ITV programs. The responsibility lies with the ITV producer that understands both television production and how learning is accomplished through television, to find a happy medium for their individual situation.

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Table 1

Prior Knowledge of Material Presented in Experimental Group Videotape

Group	N Yes	No
Basic	10	18
Advanced	16	19
Extravagant	9	20

Summary ANOVA of Prior Knowledge of Material Presented in Experimental Group Videotape

Source	SS	df	MS	F	p
Between	0.36	2	0.18	0.76	NS
Within	21.32	89	0.24		
Total	21.68	91			

Note. Prior knowledge of material presented in the experimental group videotapes was determined by the response to the question, "Are you currently taking, or have you ever taken, an economics course that teaches the same subject matter as the videotape or questionnaire?"

Table 2

Breakdown of Groups by Education Grade Level

Group	N Freshman	Sophomore	Junior	Senior
Basic	13	6	9	0
Advanced	21	9	5	0
Extravagant	14	6	7	2
Control	13	8	5	1

Summary ANOVA of the Breakdown of Groups by Education Grade Level

Source	SS	df	MS	F	p
Between	2.46	3	0.82	1.05	NS
Within	89.47	115	0.78		
Total	91.93	118			

Table 3

Summary ANOVA of Raw Scores of the Three Experimental Groups (Basic, Advanced, and Extravagant Visual Production Techniques)

Source	SS	df	MS	F	p
Between	8.00	2	4.00	0.21	NS
Within	1730.73	89	19.45		
Total	1738.73	91			

Table 4

Summary ANOVA of Raw Scores of the Control Group and the Three Experimental Groups (Basic, Advanced, and Extravagant Visual Production Techniques)

Source	SS	df	MS	F	p
Between	899.67	3	299.89	16.99	<.0001
Within	2029.47	115	17.65		
Total	2929.14	118			

Table 5

Mean Scores on Questions Whose Information was Presented Within Four Seconds After the Completion of Either an Advanced or an Extravagant Visual Production Technique

Group	N	Mean	SD	t_{obs}	p
Advanced	35	4.343	1.235	-0.219	NS
Extravagant	29	4.414	1.350		

Table 6

Mean Scores on Questions Whose Information was Presented Within Four Seconds After the Completion of Either a Basic or an Advanced Visual Production Technique

Group	N	Mean	SD	t_{obs}	p
Basic	28	5.964	1.527	0.055	NS
Advanced	35	5.943	1.533		

Table 7

Mean Scores on Questions Whose Information was Presented Within Four Seconds After the Completion of Either a Basic or an Extravagant Visual Production Technique

Group	N	Mean	SD	t_{obs}	p
Basic	28	7.893	1.969	-1.284	NS
Extravagant	29	8.621	2.290		

Table 8

Summary ANOVA of the Degree of Likeness Expressed for the Videotape by the Three Experimental Groups (Basic, Advanced, and Extravagant Visual Production Techniques)

Source	SS	df	MS	F	p
Between	2.80	2	1.40	1.91	NS
Within	65.16	89	0.73		
Total	67.96	91			

Note. Refer to Table 9 for a comparison of means scores for the degree of likeness expressed for each videotape.

Table 9

Mean Scores of the Degree of Likeness Question for the Videotape by the Three Experimental Groups (Basic, Advanced, and Extravagant Visual Production Techniques)

Group	Mean	N
Basic	2.82	28
Advanced	3.20	35
Extravagant	2.86	29

Note. A mean of 3.00 would represent a neutral condition. Means above 3.00 represent a degree of dislike for the videotape. Means below 3.00 represent a degree of likeness for the videotape.