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ABSTRACT
                In view of the dramatic increase in the use of
television in the classroom, this study examines whether television
captioning, technological enhancements to captioning like
highlighting key concepts, and the presence or absence of other
"advance organizers" in the classroom affect the comprehension and
preferences of students with learning disabilities. Four teachers
developed 15 lessons plans, each covering a different science topic.
The eighth grade science curriculum was used as a guide, and all
lessons used a common structure: goal, objectives, key concepts,
vocabulary, advance organizer, and cognitive and affective measures.
The lessons were presented to 317 students, 68 of which were
identified as having special educational needs. Research focused on
post-presentation tests in student comprehension and student reaction
to the different types of captioning—standard, edited, or
highlighted—and to the presence or absence of advance organizers.
Data analysis revealed that: (1) neither variable particularly
affected the general education students; (2) the comprehension of
special education students, however, was adversely affected by the
presence of advance organizers and by the use of edited captions; and
(3) on the other hand, the overall highest performance came when
advanced organizers were combined with highlighted captioning. The
responses suggest that: (1) students in general reported a preference
for standard captions over the other two types; (2) special education
students gave higher ratings for the captioning benefit than did
general education students; (3) for special education students there
was a significant correlation between how interesting they felt the
video was and the presence of an advance organizer; (4) students
overall gave higher interest ratings to videos that were preceded by
an advance organizer; (5) students typically rated videos without
captions more interesting than videos with captions; (6) students
rated videos without captions easier to understand than videos with
captions. The report concludes that although captioning may still be
seen as a valuable adjunct to classroom video, it may not be able to
overcome learning fluctuations caused by, among other things,
differences in the nature of the advance organizer used. Eleven
figures illustrate the data. (Contains 39 references.) (BEW)

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"Using Advance Organizers with Learning Disabled Students"

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Using Advance Organizers with Learning Disabled Students

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Introduction

Overview

How to organize and assimilate knowledge is a continuous challenge for the special education student with learning disabilities. In this study, we brought technology and learning theory together to provide an organizational and verbal structure for middle school students learning science.

The educational and motivational benefits of captioning have been established for people who are deaf or hard-of-hearing (Block & Okrand, 1983; Koskinen *et al*, 1986; Montandon, 1982; Murphy-Berman & Jorgenson, 1980; Schmidt & Haydu, 1992). Preliminary research also has shown benefits for students who have a learning disability (Koskinen, 1987) or who have limited English proficiency (Bean & Wilson, 1989; Garza, 1991; Goldman & Goldman, 1988; Neuman & Koskinen, 1992; Sokoloff, 1985).

Over the past decade, the use of television in the schools has increased dramatically. A survey by the Corporation for Public Broadcasting (CPB, 1992) reports that over 80% of teachers felt instructional television and video programs helped them teach more effectively and be more creative; over 90% felt television can have a positive impact on the quality of education and on student outcomes. The most common effects were increased enthusiasm toward school work and increased motivation to learn. Benefits accrued to all students, including special student populations such as learning disabled, moderate/severely handicapped, gifted and talented, economically disadvantaged, and limited English proficient. CPB also reported that schools have a median of one television for every 3.7 classrooms and one videocassette recorder (VCR) for every 5.9 classrooms and that over 70% of schools have either cable or satellite connections. In addition, with the advent of the Television Decoder Circuitry Act of 1990 (in effect since July 1, 1993), virtually all television sets manufactured in or imported to the United States have an integrated caption decoder. Clearly, the technology is available for captioning to be used in the classroom.

The primary goals of this project, therefore, was to determine whether captioning *per se* and technological enhancements to captioning would affect the comprehension or preferences of students with learning disabilities. Further, we sought to determine if classroom contextual factors (specifically, the presence and absence of advance organizers) would affect the comprehension or preferences of students with learning disabilities. In support of these goals were sought to determine the effects of the speed of caption presentation and the use of a highlighting technique to make key concepts more easily distinguishable within the captions.

Background

Technology has played a prominent role in learning since the printed page was introduced to the classroom and in the workplace. Kozma (1991) characterized media by its technology, symbol systems and processing capabilities. In Kozma's definition, form and function come into play for the learner; and the most obvious characteristic of a medium is its technology (eg, distinguishing between radio and television).

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The cognitive effects of the medium may rely more importantly on symbol systems and processing capabilities than on its technology. Goodman (1976) describes symbol systems as modes of appearance (words, pictures, etc) that are interrelated to fields of reference. Television may be defined as a medium capable of employing pictorial and audio-linguistic symbol systems. This medium can be enhanced by captioning, but symbol systems alone are not sufficient to describe its cognitive effects without processing capabilities.

Little research has been done on the effect of pace on comprehension. Pace is a potentially critical variable when studying video and television presentations as distinct from books. Processing information using captioned television the text is transient: It appears and disappears when replaced by the next caption. Printed text, however, is stable, allowing the reader to review passages among other things. This distinction becomes more important when pace is considered in relationship with meaningful learning chunks (Wright et al, 1984; Simon, 1974). It is within this context that our understanding of pace and knowledge transformations are subsumed under contemporary cognitive science (Bereiter, 1990). A salient feature of Bereiter's synthesis is that learners may intelligently embed the learning process within their cognitive structures and their personal goals.

The practical needs of learning and learning theory were bridged by Ausubel (1968) in which he postulated a hierarchically organized cognitive structure. Ausubel's contention was that when the learner encounters new material, if subsuming concepts were already available in his cognitive matrix, the new material is subsumed and meaningfully learned.

The early studies conducted by Ausubel and his associates are now landmarks in advance organizer research. The majority of the advance organizers Ausubel employed were verbal. Most of his findings indicated that subjects with little prior knowledge or low verbal ability benefitted more from the use of advance organizers than subjects with high prior knowledge or high verbal ability (Ausubel & Fitzgerald, 1961; Ausubel & Robinson, 1969). Various types of advance organizers have been shown to be beneficial: working models (Pella & Triezenberg, 1969), video tapes (Prescott, 1976), games (Scandura & Wells, 1967), maps (Weisberg, 1970); manipulative materials (Lesh &

Johnson, 1976), concrete models (Johnson, 1973) and comparative materials (Bayliss, 1976). Hall (1977) showed that below-average readers benefitted from graphical advance organizers.

Since the 1970's, many other studies have shown significant results in which the advance organizer as a primary variable has shown positive results. More recently, advance organizers have been incorporated into studies as adjunct learning activities, and within these learning contexts, advance organizers have been positively portrayed (Lombardi, 1992; Maldonado-Colon, 1991; Darch, 1989; Slate & Charlesworth, 1989; Spinelli & Siskin, 1987; Cunningham, 1977; Smith, 1983; Stahl-Gemake, 1982; McNinch, 1981; Graetz, 1982).

Design

The study utilized a repeated measures, split-plot design as the following table shows. The Between Ss factors are the type of captioning (three levels) and the use of an advance organizer (two levels), resulting in six distinct treatment groups. The Within Ss, repeated measures are lessons presented over time and the captioning or noncaptioning of the video.

Between Ss Factors		Within Ss/Repeated Measures Factor				Group
Captions	Advance Organizer	Baseline (No Captioning) Lessons 1-4	Introduction (Captioning) Lessons 5-8	Withdrawal (No Captioning) Lessons 9-11	Reintroduction (Captioning) Lessons 12-15	
Standard Captions	Present					1
	Absent					2
Edited Captions	Present					3
	Absent					4
Highlighted Captions	Present					5
	Absent					6

Half of the classes were asked discussion questions that served as Advance Organizers for the videos; the other half viewed videos without the introductory

discussion question. All of the classes, irrespective of whether they received advanced organizers, were assigned one of three Captioning Levels: Standard, Edited, or Highlighted. Standard captions present the near-verbatim dialogue at speeds of 150 to 180 words per minute (wpm). The Edited captions were derived from the Standard captions to achieve a maximum presentation rate of 120 wpm. Highlighted captions were created from the Edited captions by adding emphasis to key concepts by using UPPERCASE.

Sample

Seventeen intact classes comprised the sampling units. Each class was randomly assigned to a treatment group. A sample of 68 students with special educational needs (primarily learning disabilities) was obtained from a general population of 317 eighth grade students engaged in learning science.

Methods and Procedures

A group of four teachers (two science and two special education teachers) prepared 18 lesson plans, each of which covered a different science topic. The district's eighth grade science curriculum was used to guide development and arrangement of the specific lessons. All lessons were developed using a common structure: Goal, Objectives, Key Concepts, Vocabulary (with definitions), Advance Organizer, and Cognitive and Affective Measures.

Comprehension and preference measures were designed by the special education teachers to be as supportive for students with special needs. Comprehension measures used a fill-in-the-blanks format with associated word banks for the students to use in making their choices. Preference measures were formatted to make the ratings as easy as possible.

A content validation of the lessons was obtained by having the lessons independently evaluated by additional science and special education teachers, as well as by key administrative and science curriculum personnel. A meeting was then held

where the reviewers presented their findings and recommendations. This resulted in changes to several lessons, and three lessons were removed entirely on the basis of inadequate safety measures being used.

Data Collection

Data were collected from late September through early December. Four on-site data collectors were assigned to the five participating schools, providing each teacher with a single contact point for questions or problems, and for scheduling data collection days. Data collectors were responsible for delivering print and video materials to each teacher, providing technical assistance for the technology, ensuring consistent and appropriate delivery of treatments, ensuring the anonymity of students and confidentiality of their scores, and ensuring consistent and appropriate scoring and coding of responses.

Data Analysis

Test data were pooled for each student for each treatment sequence. This resulted in four average scores for each student: one for lessons 1-4, one for lessons 5-8, one for lessons 9-11, and one for lessons 12-15. This pooling reflects the split-plot, repeated measures design. It also simplifies the analysis and minimizes the potential confounding effect of variable lesson difficulty.

Data analyses were conducted using SPSS/PC+ for the IBM PC. Multivariate analysis of variance (MANOVA) and various descriptive procedures were utilized.

Before undertaking the analysis of the cognitive and affective data, systematic differences between the groups were analyzed in terms of prior achievement. This was accomplished by analyzing the students' performances on the Maryland Functional Reading Test (MFRT) and the Maryland Functional Math Test (MFMT), which were administered to all eighth grade students in the district. MANOVA analyses revealed a significant difference in prior mathematics achievement ($F = 2.534$, $p = .029$), therefore, the comprehension analyses utilized multivariate analysis of covariance (MANCOVA) with the MFMT scores as the covariate.

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The special education students in the sample were classified by the school district either as "Other Special Education" or "Learning Disabled." These two groups were compared resulting in no statistically significant difference in terms of MFMT scores ($F = 1.386$, $p = .210$). Therefore, the two subgroups were combined to form one "special education" group for the analyses.

For the analysis of the data for the full sample, the design was extended to incorporate a categorical variable denoting educational classification. This variable was assigned the value of 1 for general education students and 2 for special education students.

Results

Analysis of Comprehension

Between Ss Effects

Significant results were obtained for the following: covariate ($F = 97.25$, $p = .000$), type of captioning ($F = 4.23$, $p = .015$), advance organizers ($F = 3.93$, $p = .048$), and educational classification ($F = 23.44$, $p = .000$). These results illustrate fundamental differences between general and special education students under these conditions.

Comprehension

Legend
— GenEd-Adv
— GenEd-NoAdv
— SpecEd-Adv
— SpecEd-NoAdv
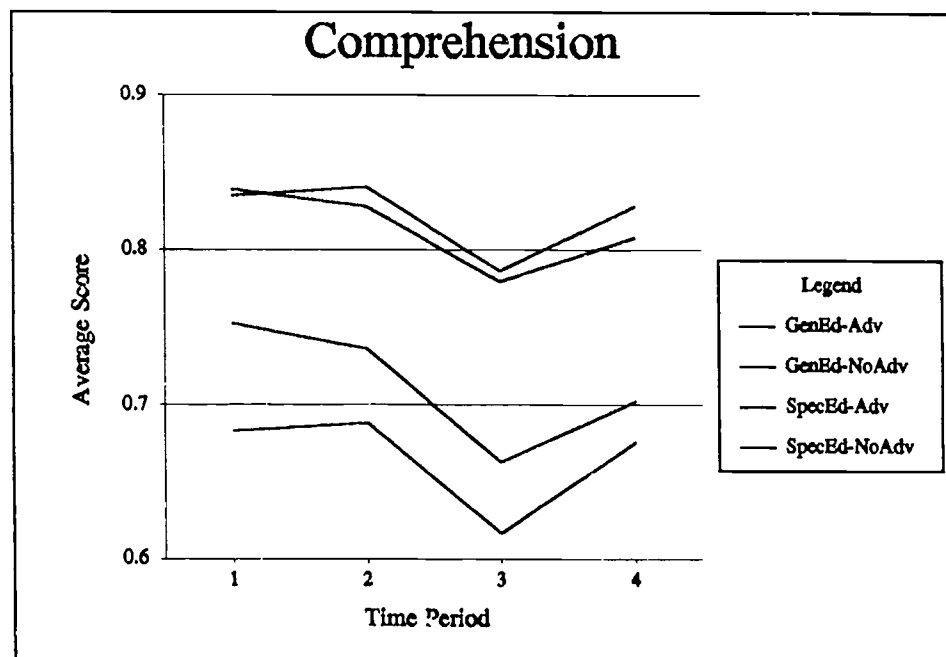
Significant interactions also were obtained. These included a second-order interaction of advance organizer and educational classification (F = 5.76, p = .017) and a third-order interaction of type of captior.'ng by advance organizer by educational classification (F = 3.56, p = .030).
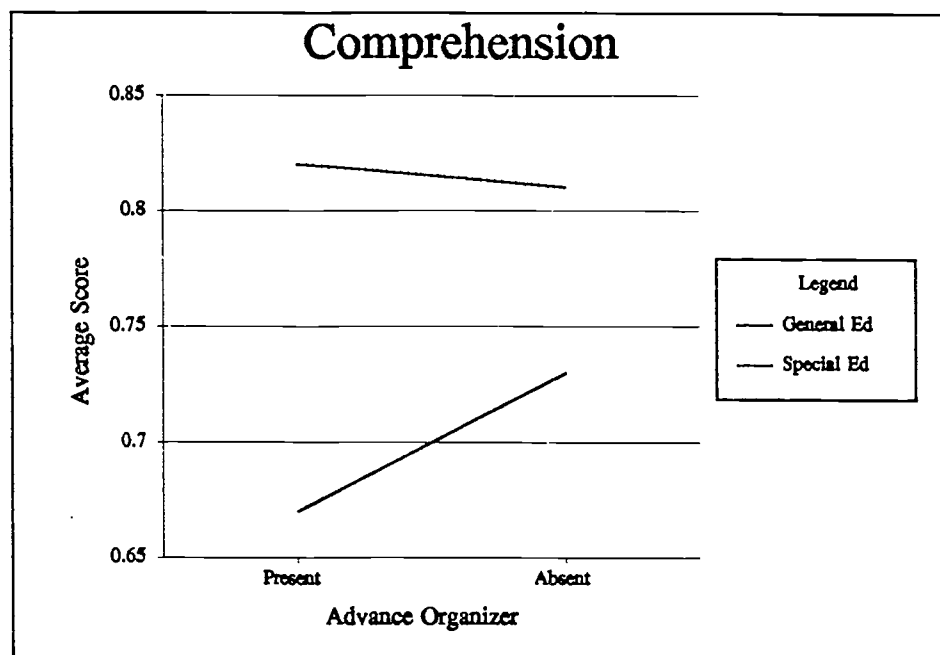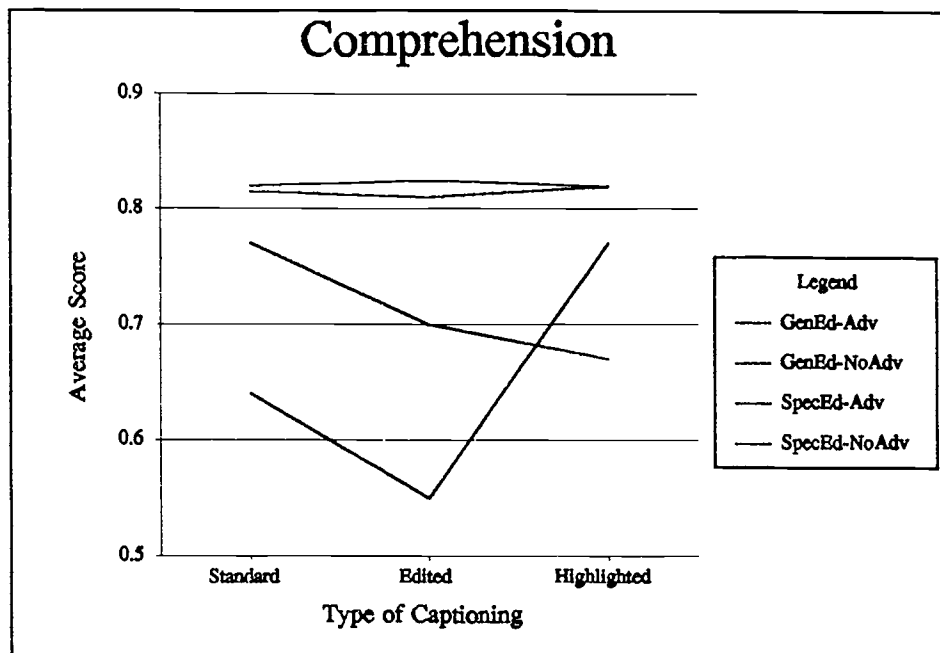
Comprehension

The effect of the advance organizer was *negative* for the special education students: They achieved better performance on average on the comprehension measure when the advance organizer was *absent*. In contrast, advance organizers did riot affect comprehension for general education students.

It also may be noted that there was relatively little variability in comprehension for the general education students. The learning situation for special education students, however, is much more variable and clearly is influenced by classroom contextual factors, including the advance organizers and the different types of captioning.
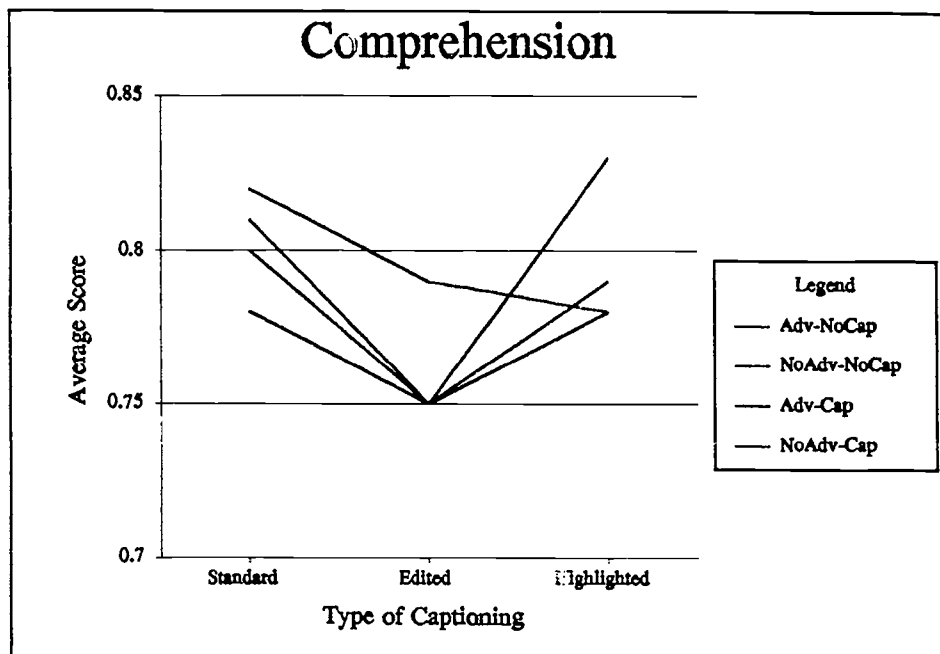
The next figure illustrates the third-order interaction of type of captioning, advance organizers, and educational classification. Again, it may be seen that the comprehension of the video content by general education students was not affected appreciably by the advance organizer or by the type of captioning. Special education students, in contrast, were adversely affected by the advance organizers and by editing of the captions.

The critical exception to this is the case when the advance organizer was coupled with highlighted key concepts. This combination resulted in performance comparable to performance with standard captions and no advance organizer.

Comprehension

Legend
— GenEd-Adv
— GenEd-NoAdv
— SpecEd-Adv
— SpecEd-NoAdv

Within Ss Effects

Whether the video was captioned or not was significant ($F = 5.60$, $p = .019$). This demonstrates a consistent comprehension benefit for students who viewed the video lessons with captions. A third-order interaction, type of captioning by advance organizer by video captioned, was significant ($F = 5.93$, $p = .003$).

Comprehension

Average Score vs. Type of Captioning (Standard, Edited, Highlighted)

Legend
- Adv-NoCap
- NoAdv-NoCap
- Adv-Cap
- NoAdv-Cap

This interaction is similar to the third order, Between Ss interaction (above), only more pronounced. The overall highest performance for a single group (out of the six groups in the study) was achieved when the video was captioned, the type of captioning was highlighting, and advance organizers were used. The second highest performance was when the video was captioned, the type of captioning was standard, and no advance organizer was used. In general, performance was lower overall for edited captions and for advance organizers.

Analysis of Affective Measures

Each lesson's assessment instrument included an affective scale composed of three or five items, depending on whether the video was shown with captions or not. These data were scored on a scale of 1 to 4, with 1 being negative and 2 through 4 being progressively more positive.

To simplify the presentation of the data in the following table, student responses to the five scales were recoded into a single, dichotomous scale using an average score as the cutoff point. The cutoff points were selected to ensure that a student who rated the majority of the videos either positively or negatively would be placed in the

appropriate category on the new scale. For the recoded questions, descriptive statistics were then calculated. The following table summarizes the data:

| Attitude Items (Rephrased as Statements)	Percentage Agreement	
	Entire Sample (n = 317)	Special Ed Students (n = 68)
I thought the videos were interesting.	96%	96%
I thought the videos were easy to understand.	100%	100%
I already had some knowledge of the video content.	97%	93%
Captions helped me understand the videos.	54%	66%
I liked the captions.	49%	53%

A further, detailed analysis of preferences followed the same procedures as the analysis of comprehension, except that MANOVA was used instead of MANCOVA. Each of the affective questions was pooled over time in the same manner as the cognitive measures, resulting in four repeated measures of attitudes for each student for questions 1 through 3. Questions 4 and 5 were present only for videos that were captioned, so only two repeated measures were collected.

Captions and Understanding

This question addressed whether the captions helped the students understand the video or not. Significant Between Ss effects were obtained for type of captioning (F = 4.46, p = .006) and for educational classification (F = 7.78, p = .006).

		Caption Introduction	Caption Reintroduction
Type of Captioning	Standard	2.1960	2.0983
	Edited	1.8946	1.9547
	Highlighted	1.7810	1.6687
Educational Class.	General	1.9277	1.8394
	Special	2.1385	2.1385
Entire Sample		1.9729	1.9035

For all students, standard captions were judged to be more helpful in understanding the videos than either edited or highlighted captions. Interestingly, special education students gave higher ratings for the captioning benefit than did general education students. There also was an interaction of type of captioning by advance organizers $(F = 3.44, p = .033)$ as is illustrated in the following figure:

Captions & Understanding
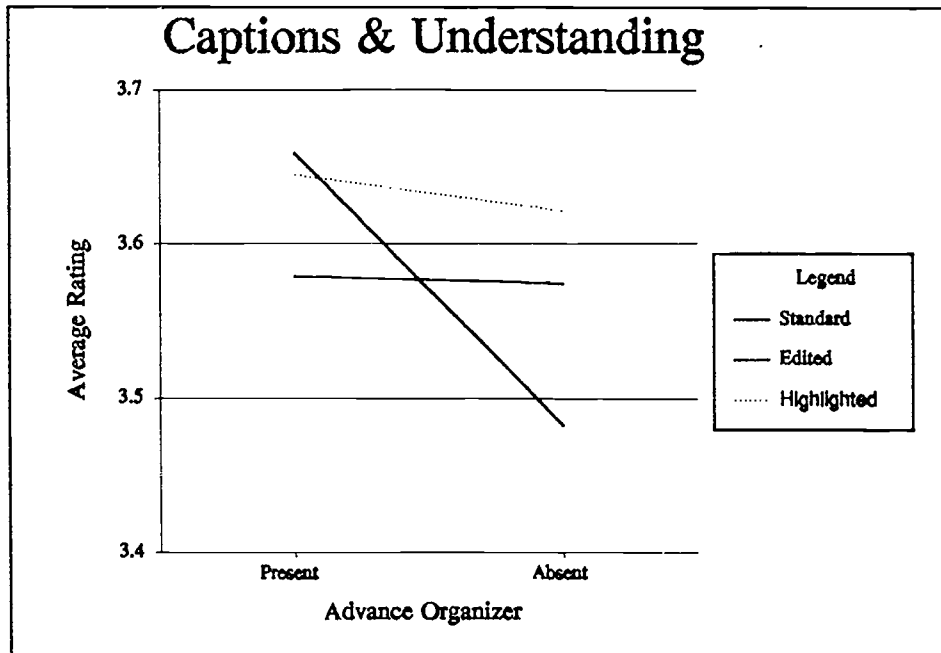
Liking of Captions

This item asked students if they liked the captions. Between Ss effects were obtained for type of captioning $(F = 6.84, p = .001)$ and educational classification $(F = 4.13, p = .043)$. A Within Ss effect was obtained for advance organizers over time $(F = 4.31, p = .039)$.

Liking of Captions
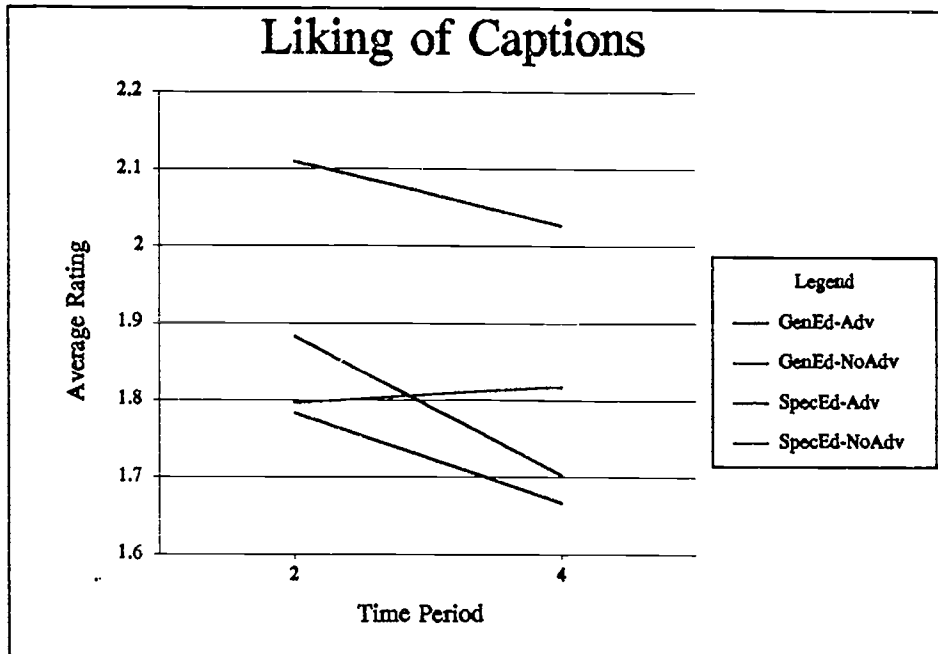
Interest

This question asked the students how interesting they found the video. For special education students there was a significant correlation between interest ratings and advance organizers ($r = .2418$, $p = .047$); however, there was no such relation for general education students. A significant Between Ss main effect was obtained for the advance organizers ($F = 9.13$, $p = .003$). Students overall gave higher ratings to videos that were preceded by an advance organizer. There was a significant Between Ss second order interaction of type of captioning and advance organizer ($F = 4.02$, $p = .019$).
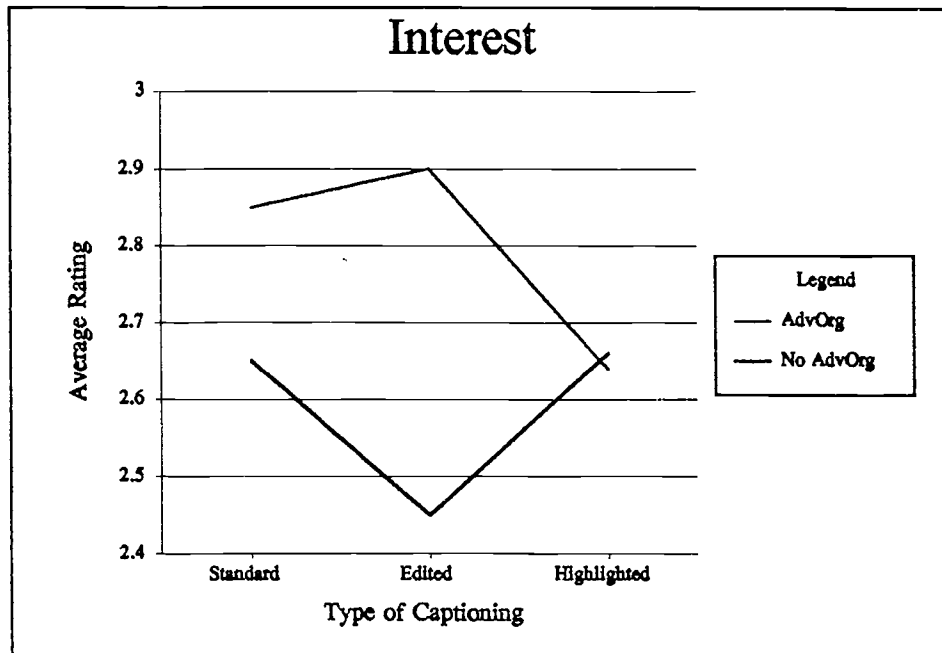
Interest

Interest ratings over time were significantly different ($F = 10.67$, $p = .001$). Ratings declined from baseline to caption introduction and from caption introduction to caption withdrawal. Interest then rebounded modestly with the reintroduction of captioning, perhaps suggesting that the students had become more accustomed to the technology. There also was a significant effect based on whether the video was captioned or not ($F = 5.74$, $p = .017$). Students expressed higher interest for videos that were not captioned than for videos that were captioned.

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Interest in Videos

Legend
— GenEd-Adv
— GenEd-NoAdv
— SpecEd-Adv
— SpecEd-NoAdv
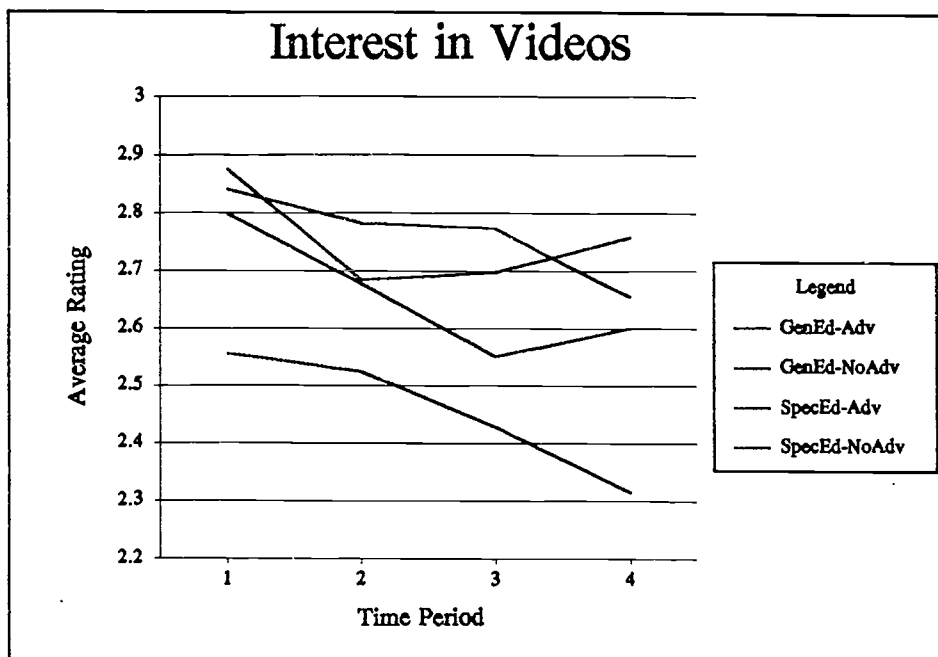
Ease of Understanding Videos

There was a significant Between Ss main effect based on the students' educational classification (F = 8.41, p = .004). This reflects the consistently lower ratings for ease of understanding that were given by students with special educational needs. There was no significant correlation between ease of understanding ratings and advance organizers. There was a significant Within Ss effect based on whether the video was captioned or not (F = 35.01, p = .000): In general, students rated videos that were *not* captioned to be easier to understand than videos that were captioned; however, both of these average ratings are quite high.

Discussion

It appears that captioning provides a successful learning environment for students. The highest performance by a single group was obtained by Highlighted captions with Advance Organizers, followed by Standard Captions without Advance Organizers; and when captions were withdrawn all groups' performances declined. And two-thirds of the special education students felt the captions helped them understand the videos. Given

the widespread availability of captioned materials and decoders, captioning is a valuable adjunct when video is used in the classroom.

Our recommendation to include captioned videos in inclusion settings, however, is made with some caution. These analyses revealed pronounced variability in comprehension for special education students. The potential benefit of the captioned television media may lead to positive results, as we observed, but the media cannot obviate learning fluctuations that skilled teachers handle on a daily basis.

How advance organizers relate to the learning process presents some interesting observations and implications. Why did groups receiving advance organizers and standard and edited captioning demonstrate lower comprehension scores? First, let us consider the nature of the advance organizer. The students were presented with an advance organizer in the form of an open-ended question posed to the class for discussion. Teachers were careful to avoid revealing the concepts and terminology used in the video. The lack of closure may have resulted in confusion on the part of the special education students prior to viewing the video. The combination of the prior discussion, the captions, and the science content of the video (both aural and visual) may have resulted in a sensory or cognitive overload. Additionally, the students knew they would be facing a test immediately after the video, which may have further distracted them.

Based on Ausubel's (1968) definition of an advance organizer and Bereiter's (1990) educational learning theory, the organizer should be conceptual, the content should be presented in meaningful chunks, and testing should reflect higher order thinking. The fifteen lesson plans appeared to be excellent, but they were not interrelated. Thus, advance organizers could only be presented on the same cognitive level as the lesson. Furthermore, the nature of the advance organizer must be considered. Should it be graphical, so as not to interfere with the concept, or verbal, to enhance word understanding? Of the research studies that employed nonwritten advance organizers, most achieved significant, positive results (Bayliss, 1976; Hall, 1977; Lesh & Johnson, 1976; Pella & Triezenberg, 1969; Prescott, 1976; and Scandura & Wells, 1967).

It is within the tradition of this research that we recommend captioned videos to be used with advance organizers, provided the visual presentation introduces and supports the development of verbal images. Although a simple classroom discussion question may be useful for stimulating student interest, it does not appear to be sufficiently conceptual to be used as an advance organizer.

The relation of advance organizers with higher interest scores and the different relationship to comprehension scores for general and special education groups suggests the importance of domain learning, as has been reviewed by Alexander, Kulikowich and Jetton (1994). One of their salient points is that the "most powerful and positive learning outcomes occur in those contexts where students' knowledge and interests are well matched to the nature of the learning task." This has direct implications for this study and for others that incorporate media. Our results indicate that personal interest in the content area for special education students is yet to be realized.

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