Efficacy of Video Instruction Meta-Analysis:

Preliminary Findings

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Abstract

The study quantitatively synthesized the efficacy of video instruction presented in various formats as an intervention tool for teaching academic, functional, and behavioral skills to school-aged children with and without disabilities. Fifty one studies, including 24 with group design and 25 that employed single subject research, were integrated through a meta-analysis technique. Overall effect size in group studies (.57) yielded the conclusion that video instruction could be relatively effective when working with students with disabilities. Percent of non-overlapping data from single subject studies demonstrated that video instruction also moderately effective for teaching students with disabilities (78.5%). Preliminary findings included in this study are used to initiate a comparative analysis of different video formats, applications, and interactivity features as they are used in educational settings.

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Introduction

The world of technology rapidly grows and changes every day. Devices that used to be considered highly technological and sophisticated surround us now making it hard to imagine life without them. Familiar technologies like TV and video can also mean an easy to use teaching tool that students benefit from while teachers are not afraid of it. Over the last three decades video formats have changed from videodiscs to videotapes; DVDs and computer-based videos. Regardless of the format, video continues to be widely used in general and education classrooms for teaching various academic (Bottge, et al., 2001; Hitchcock, Prater, & Dowrick, 2004; Lee, & Vail, 2005) as well as functional (Graves, Collins, & Scchuster, 2005; Mechling, Gast, & Langone, 2002; Van Laarhoven, & Van Laarhoven-Myers, 2006) and behavioral skills (Maione, & Mirenda, 2006; Schreibman, Whalen, & Stahmer, 2000; Shipley-Benamou, Lutzker, &Taubman, 2002). This review is aimed to look at video instruction as an educational intervention specifically in general and special K-12 education.

While it is probably safe to suggest that everybody nowadays knows what video is, video instruction can be delivered through various arrangements. Linear video provides the lowest interactivity level offering passive watching without a possibility of feedback or students' active participation (Cronin & Cronin, 1992; Mechling, 2005). Along with the commercially created and published videos, movies created by teachers present another form of video technology. A majority of instructor-created clips are content relevant to each individual learner's needs and include modeling example or non-examples as well as self-modeling techniques (Mechling, 2005). However, videos created in the classroom environment are not limited to linear ones.

Several software programs exist that help design more interactive clips. Hyperstudio, PowerPoint, iMovie are just a few examples of authoring programs used by teachers to create means for interactive video instruction (Hitchcock, Prater, & Dowrick, 2004; Mechling, Gast, & Langone, 2002; Van Laarhoven, & Van Laarhoven-Myers, 2006).

Video Instruction Formats

Video instruction was greatly transformed following the development and increased interest to “anchored instruction.” Based on the ideas of Whitehead (1929) about people’s ability to recall inert knowledge when asked to do so, not using if for simultaneous problem solving, anchored instruction was conceptualized by the Cognition and Technology Group at Vanderbilt (CTGV, 1990). The major initiative was to offer information to students through various means including specifically designed video clips that provided conceptualized background, anchors supporting students’ previous knowledge for meaningful problem-solving knowledge rather than pointless memorization of facts (Moore, Rieth, & Ebeling, 1993). Anchored instruction started with two programs The Young Sherlock Program for literacy and social studies and The Jasper Woodbury Problem Solving Series, primarily focused on math with cross-curricular links. Video anchors in both of those programs provided students, teachers, and others involved with some common knowledge that ensured active engagement of participants with different backgrounds (CTGV, 1990, 1992, 1993; Kinzer, Gabella, & Rieth, 1994).

Anchored video instruction introduced a new type of video with several interactive features including hyperlinks, feedback, and data collection systems. However, it also required a different instructional approach. Instead of supplementing traditional teaching activities with linear videos, anchored instruction focused on providing students with opportunities to construct their own knowledge through the seamlessly embedded video teaching moments (Love, 2004).

Several studies have found anchored instruction effective in increasing performance of students with and without disabilities in different academic areas (Beaver, 1995; Bottge, et al., 2002; Shyu, 2000).

This transition from teachers being the experts in the classroom to more a guiding, scaffolding type of instructional delivery continued in other forms of interactive videos. While hyperlinks prove to be very effective elements of interactive video (Zahn, Barquero, & Schwan, 2004), they are not the only required elements. In his literature review of computer-based tools for learning science Weller (1996) defines interactive video as “a videodisc linked with a computer microprocessor, enabling the information from the videodisc to be controlled by the computer so that the system can react to learner behaviors.” Further convergence between television and computer allows active two-way participation, advancement, and progress monitoring, thus ensuring individualized instruction (Wetzel, Radtke, & Stern, 1994). Nowadays, interactive video is coming near a new chapter featuring streaming video delivered in real time over the Internet (Martindale, 2002). However, the body of research is yet to be accumulated.

Needless to say, video is widely used for teaching students with various disabilities. One of the popular areas of video implementation is modeling and self-modeling for students with disabilities, especially for those with autism. “Video modeling presents the performance of a skill by a model such as a same-age peer or adult without disability” (p.27) (Mechling, 2005). Self-modeling is defined as observations of oneself successfully engaged in adapted behavior at a more advanced level than the one they actually can perform (Hitchhock, Dowrick, & Prater, 2003; Mechling, 2005). Two different techniques can be used in video self-modeling. One is a positive self-review, when students watch the video of themselves edited to delete all errors. The second technique is feedforwarding, when subskills are videotaped and combined into a complete task, self-modeling appears to be a promising tool for teaching students with disabilities (Dowrick, 1999; Mechling 2005).

Existing Reviews of Literature

Regardless of interactivity level, multiple presentation formats offered by video enhances students comprehension, memory as well as attention skills (Moore, Rieth, & Ebeling, 1993). Several reviews of literature summarized the effects of video instruction on students with and without disabilities. Hitchhock, Dowrick and Prater (2003) presented a review of 18 articles examining the effects of video self-modeling in school-based settings. They reported moderate to strong outcomes of video self-modeling on teaching various academic, behavior, and functional skills to students with disabilities and/or at-risk.

Ayres and Langone (2005) focused their review of literature on video instruction and intervention specifically for students with autism. Once again video was found to be an effective tool for teaching conversational, shopping, and other daily living skills to students with autism. While this review targeted mostly linear modeling video, the researchers raised the issue of built-in feedback and interactive features possibility to “create the optimal learning environment” (p.195) for this population.

Mechling (2005) puts another spin on the topic and reviews instructor-created video programs used to teach students with disabilities. By definition teacher-created videos imply more individualized content. Once again a majority of studies demonstrated positive effects of different forms of video instruction including video feedback, video modeling and self-modeling, as well as more interactive computer-based video.

While all literature reviews report improvement with video instruction, the extent of its effectiveness remains unclear. The most recent quantifiable meta-analysis was conducted by

McNeil & Nelson (1991) and investigated achievement outcomes from interactive video instruction. It synthesized 63 studies that reported performance or cognitive outcomes for interactive video and control groups. It reported a relative effectiveness of only one form of video instruction, interactive video, on one dependent measure, achievement in educational, military, and private industry sectors (**.53**). However, current effectiveness of video instruction is unknown. In addition, little evidence exist examining different formats of teaching with video comparatively. Thus, this study is a logical replication and extension of McNeil & Nelson study examining various types of video instruction suggesting different interactivity levels for students with and without disabilities.

The purpose of this study is to synthesize existing research in video instruction. It is an attempt to construct "the big picture" of how video is used currently in educational settings and how it is compared across populations and applications. This analysis examines standardized effects of different forms of video instruction as an intervention in the effort to compare those forms.

Research Questions

The focal matter in this review concerns the effectiveness of different video instructional forms for teaching students with and without disabilities in a school setting. The specific research questions are as follows:

1. What are the main areas of instructional content that utilize education via video in K-12 grades with students with and without disabilities?
2. How do different video forms and their interactive features relate to the age, placement, and ability group of students?

In addition, a number of specific, additional questions will be addressed related to factors that may moderate effectiveness of different forms of video instruction for students with and without disabilities.

Method

Literature Search Procedures

Video instruction efficacy studies were located by searching the major electronic databases: PsycINFO, Social Sciences Citation Index, Educational Resources Informational Center (ERIC & EDRS), and Digital Dissertation Abstracts. The search was carried out based on the following descriptors: anchored instruction, video instruction, videotape instruction, interactive video, computer-based video instruction, video modeling and video self-modeling. Furthermore, a search of selected studies' references as well as tables of contents in relevant journals was conducted to locate additional studies.

Criteria for selecting studies

The inclusion criteria were limited to include only studies that:

- Examined video as an intervention
- Referred to any type of video instruction mentioned (linear video, anchored instruction, interactive video, modeling, and self-modeling)
- Included K-12 students with and without disabilities.
- Articles were dated between 1991 and 2006 including federal reports and unpublished doctoral dissertation and master thesis

Although additional studies focusing on the effectiveness of video instruction for undergraduate/graduate/college/nursing/psychology students, teachers, adults (e.g., Cannela-Malone, et al., 2006) were identified, they were not included in this meta-analysis. In addition, articles addressing videoconferencing, video games, distance education, higher education, nursing medicine, sport, position papers (e.g.,) were excluded from this analysis. Furthermore, studies where it was impossible to calculate a standardized measure of effect size due to missing data in experimental studies (e.g.,) or to calculate a percent of non-overlapping data (PND) score due to inappropriate visual representation of data in single-subject research studies (e.g., Kinney, Vedora, & Stromer, 2003) were also excluded from the study. A total of 51 studies were coded.

Coding Instrument

A coding system along with coding conventions was developed to identify and analyze the effectiveness of video instruction and its factors in each study. Adapted from a coding sheet created by McNeil and Nelson (1991) for their meta-analysis of interactive video instruction, the present coding system included variables in the following areas:

- Introduction (9 items including study ID, author, year, source, type of publication, study design, assignment of students, classes, and teachers to different conditions, and study quality);
- Sample Characteristics (21 items including demographic information about the participants (students and teachers) as well as location information);
- Intervention Characteristics (32 items including setting, intervener, instruction group size, dependent variables, items describing interactive video implementation, its features and content, video format and length, as well as study duration);
- Study Outcomes (10 items including findings reported by the researcher, the magnitude of the standardized mean difference effect size as well as percent of non-overlapping data for single-subject research studies).

Several variables were defined and coded according to operationalized definitions and coding conventions. For example, the level of video interactivity was defined as:

- Low: videos with linear format allowing students just to watch it. Video clips incorporated text, pictures and audio directions were still included in low category since those elements do not provide students with interaction opportunities.
- Medium: videos that included hyperlinks/buttons and those that were available for students to search (going back and forth) were considered of medium interactivity;
- High: videos providing students with feedback based on their actions, moving/advancing to another level based on the entered into the video program response/information, as well as those collecting students' performance data were identified as high interactivity level videos.

In addition, the experimental and single-subject design studies were examined and coded for quality following the criteria:

- High quality study:
    - Experimental: included random assignment of students, classroom, and/or teachers to instructional conditions, addressed reliability issues (e.g., Cronbach alpha), and correct statistical tests results and/or complete descriptive statistics reported;
    - Single-subject: replicated across participants, settings, or materials (external validity); the intervention is operationalized (explained in detail); fidelity of treatment is reported; at least three data points in each phase; stable baseline; interobserver reliability reported in details; social validity addressed;
- Medium quality studies:

  - Experimental: not-random assignment (quasi-experimental), correct statistical tests results and/or complete descriptive statistics reported;
  - Single-subject design: replicated across participants, settings, or materials (external validity); at least three data points in each phase; interobserver reliability reported in details;
- Low quality studies:
  - Experimental: one group only designs;
  - Single-subject design: single participant, setting, material; less than three data points in any phase.

Calculations

The effectiveness of a treatment group over a control group in standard deviation units (Glass, McGraw, & Smith, 1981) was calculated using the formula $(X_E – X_C) \div (SD_E + SD_C)/2$. In those cases when both the pretest and posttest descriptive data for both experimental and control groups were reported, the formula $(X_{E\ posttest} – X_{E\ pretest}) – (X_{C\ posttest} – X_{C\ pretest}) \div (SD_{E\ posttest} + SD_{E\ pretest} + SD_{C\ posttest} + SD_{C\ pretest})/4$ was used to control for pre-existing differences between groups. Effect size in low-quality studies examining one group only and repeated measures designs (without control) were calculated using the pretest-posttest data from that group $(X_{posttest} – X_{pretest}) \div SD_{pretest}$. Delayed posttest data were compared to the pretest $((X_{E\ delayed\ posttest} – X_{E\ pretest}) – (X_{C\ delayed\ posttest} – X_{C\ pretest}) \div (SD_{E\ delayed\ posttest} + SD_{E\ pretest} + SD_{C\ delayed\ posttest} + SD_{C\ pretest})/4$. Each study could have several effect sizes based on the number of conditions and dependent measures.

The effectiveness of video instruction from single-subject research studies was calculated using the percentage of non-overlapping data (PND) score revealing “the proportion of overlapping data displayed between treatment and baseline” (p. 27) (Scruggs, Mastropieri, & Casto, 1987). A larger PND stands for the higher effectiveness of an intervention. In those studies that employed multiple probe design and graphed both training and mastery probes, only mastery probes were compared to the baseline. In those studies that collected and reported more than 3 data points for follow-up stage the separate PND score for the maintenance phase was calculated. It is important to note that PND score was calculated for each dependent measure in the study, thus, sometimes producing multiple PND scores per each study.

Coding Procedures and Interrater Reliability

The primary researcher coded the majority of articles. However, throughout the study random sample (about 15% of all studies included in this meta-analysis) were given to an independent person to make sure she coded them the same way as the researcher. The reliability checker was unfamiliar with the purpose of this study but was informed and trained in coding system and conventions. Interrater reliability of coding was 95%.

Overall Characteristics of the Data Set

Fifty-one studies met the selection criteria and were included in the study. That number includes 24 group research and 25 single subject research studies. The reference list of publications included in the meta-analysis is attached in the Appendix. All included studies were published between 1991 and 2006 in 28 different general, special education, and technology related journals, reports and unpublished dissertations. Meta-analysis coding resulted in 124 effect sizes (from 24 experimental studies) and 66 PND scores (from 25 single-subject studies). Among experimental studies 55% employed either treatment versus control design, 37% repeated measures or one treatment versus another, and 8% one group only design. Among single-subject design studies the number of multiple baseline (52%) and multiple probe (40%) prevailed over alternating treatments designs (8%).

Across group research and single-subject, 31% of studies examined the effectiveness of video instruction on students without disabilities while students with disabilities are represented in % of studies, specifically students with mental retardation (26%), autism (24%), learning disabilities (4%), and mixed groups (15%). Throughout all the studies terms “anchored instruction”, “interactive video instruction”, “video modeling”, and “self-modeling” were used interchangeably. Thus, further analysis is required in order to determine the percentage of each form of video instruction within the analysis sample.

Results

Overall Effect of Video Instruction

Across all the group research design studies, overall effect size was .**57** (SD= .88) suggesting that video instruction is relatively effective for teaching a variety of skills including academic, functional, and social skills. It is important to note that further analysis revealed that studies comparing video instruction to a no treatment/control group produced better overall effect size (**.70**, SD = 1.09) than studies in which both groups received video instruction, thus evaluating different components of the video as an instructional tool (**.43**, SD= .64). More explicit analysis of such studies will be provided later (after additional coding is completed).

<INSERT TABLE 1 HERE>

In addition, low quality studies that employed convenience sampling or one group designs demonstrated much higher effectiveness of video instruction (**1.26**, SD=1.46) than those of medium and high quality **.44** (SD= .64) and **.48** (SD= .80) respectively. On the same line, studies with less than 20 participants in the experimental group demonstrated lower effect sizes (**.31**, SD= .70) than those with 20-50 subjects (**.57**, SD= .80) and those with more than 50 (**.94**, SD=1.32).

Single subject research design studies produced higher overall PND score (**78.5**%, SD=24.62). Thus, it is possible to conclude that single subject studies demonstrate moderately high overall effect of video instruction than group research studies. It is important to note that all 25 studies were considered high quality based on the coding convention provided above. All publications presented rigorous single subject research activities addressing all elements necessary for high quality single subject study.

Findings for Key Variables

Students of different abilities. The results of this meta-analysis demonstrate obvious interaction between video instruction and students' different ability levels. Group research studies revealed that students without disabilities somewhat improved on the post assessment measures (**.51**, SD= .79) while students with disabilities improved even more (**.99**, SD=1.24), leaving effect size **.12** (SD= .66) to studies that featured mixed groups with students with and without disabilities.

<ENTER TABLE 2 HERE>

Such results are corroborated by the high overall PND score (**78.5**%, SD=24.62) because only students with disabilities participated in single subject research studies. Among that population, students with mental retardation benefited from video instruction slightly more (**88.6%**, SD=15.82) than students with autism (**75.1%**, SD=25.09).

Age differences. Examining the total sample sizes regardless of the ability group, we discovered that high-school students responded slightly better on video instruction (**.76**, SD=1.4) than elementary and middle aged students **.55** (SD= .89) and **.38** (SD= .68) respectively. However, more detailed analysis revealed results presented in Table 3.

<INSERT TABLE 3 HERE>

These results indicate that those students without disabilities improved more in elementary grades (**.58**, SD= .93) than in middle and high school. On the other hand, students with disabilities perform better in middle school (**.78**, SD=1.2) rather than elementary grades. One extremely large effect size representing students with disabilities in high school (**5.09**) needs to be further analyzed and probably corrected before making the final conclusion.

Findings from single-subject research studies support the conclusion that students with disabilities benefit from video instruction in higher grades. High school students demonstrated higher PND score (**83.1**%, SD=22.64) than students in middle (**82.5**%, SD=10.61) elementary (**68.1%**, SD=20.69) grades, and pre-school (**75.3%**, SD=34.25).

Setting and location. Overall effect sizes for population density are relatively equal for different regions indicating that effect size is **.65** (SD=1.13) for rural areas, **.65** (SD= .91) for suburban, **.67** (SD= .81) for rural, and **.43** (SD= .61) for metropolitan areas. However, PND scores reveal greater improvement in urban and suburban areas (**95%**, SD=9.37) rather than rural (**69%**, SD=21.40). Nevertheless, this data should be analyzed with caution because a majority of single subject research studies failed to report the location of the study.

The findings from the group research studies that video instruction is more effective in special education settings (**.80**, SD=1.4) support previous conclusions that students with disabilities benefit greater from such instruction. Video instruction in regular education settings including classrooms and computer labs shows effect size **.49** (SD= .79). Other settings (**0.84**, SD= .86) included behavior programs, therapy rooms, researchers' offices as well as studies that changed settings throughout its duration (e.g., classroom and computer lab). More in-depth analysis revealed that students without disabilities were always instructed in regular education settings (**.51**, SD= .80) while students with disabilities were consistently instructed in special education settings (**1.13**, SD=1.54). In addition, students with disabilities also performed well in "other" settings (**.84**, SD= .86). It is not surprising because "other" settings described above imply one-on-one or small group instruction. Moreover, in both settings elementary group students (both with and without disabilities) performed better (regular classrooms = **.58**, SD= .93 and special education settings = **.42**, SD= .26) than other age groups.

A majority of special education students participating in single subject research studies received instruction in special education setting (**82%**, SD=23.21) and "other" settings (**82%**, SD=23.01) and were equally successful. Unfortunately, only 4 PND scores represent students with autism who received instruction in regular classroom. Such a small proportion does not allow us to compare these findings to the ones from group research studies. However, in addition to settings discussed earlier, single subject research studies were conducted in participants' homes. Presenting video instruction in home environment appears to have a potential (**65.6%**, SD=18.89).

Instructional content of video. It was determined that various forms of video instruction are used for teaching students with and without disabilities academic, functional, and behavioral skills. Group research studies demonstrate that teaching academic content to students without disabilities utilizing video equipment can be effective (**.51**, SD= .79) and even more effective when teaching it to students with disabilities (**.98**, SD=1.54). Moreover, following the Cronin & Cronin's framework (1992), we compared effects of interactive video instruction in hard skills areas (science and math) and soft skill areas (language arts and social studies). The results indicate that students without disabilities perform better in soft skill areas after video instruction (**.73**, SD= .98) while students with disabilities benefit from video instruction more in hard skill areas (**1.64**, SD=2.20). Further analysis across grade levels and video interactive features did not reveal any significant differences. More analysis is necessary.

In single subject research studies, video instruction was used primarily for teaching functional skills (**88.3%,** SD=15.18) and social behaviors (**70.5%,** SD=29.39). It is interesting that modeling videos were slightly more effective for both functional (**93.5%,** SD=9.68) and behavioral (**70.2%**, SD=32.6) skills than self-modeling (functional = **83.5%**, SD=14.85 and behavioral = **67.4%,** SD=22.27)

Delivery group size. Students who received small group instruction performed better (**.66**, SD=1.05) than those in large groups (**.41**, SD= .62). However, it is interesting that students who received one-on-one guided instruction (with teacher guiding/scaffolding) (**.84**, SD= .86)) significantly outperformed those working with video independently without supervision (**.18**, SD= .59). Further analysis shoes that only students with disabilities received one-on-one guided instruction. Students without disabilities were the only participants in individual and large-group instruction was only for students without disabilities. In small groups students with disabilities performed relatively better (**.94**, SD=1.57) than students without disabilities (**.71**, SD= .89). In turn, students without disabilities performed better in small-groups (**.71**, SD=.89) than in large groups (**.40**, SD= .66). Furthermore, students with disabilities were slightly more successful in small groups (.94, SD=1.57) than in one-on-one guided instruction (**.84**, SD= .86).

Based on the this preliminary analysis students with disabilities who participated in single-subject research studies have more severe disabilities than those in group research studies. Across all single subject research studies those students received instruction either individually or in one-on-one situation. Overall PND scores for different instruction delivery group sizes indicated that they responded almost equally working individually (80.2%, SD=28.9) or one-on-one with a teacher (**76.2%**, SD=20.2)

Replacement or supplement of instruction. Both overall effect sizes and PND scores demonstrated that video instruction can be effective when it reinforces previous instruction **.94** (SD=1.02) and **68.4%** (SD=25.05). However, the results indicate that video instruction as a replacement (**.64**, SD=1.01) is more effective than as a supplement to instruction (**.33**, SD= .66). PND findings are parallel in that they reveal that replacement of instruction with video is the major way it is used (**80.6%**, SD=24.13).

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Further analysis allows suggesting that the explanation can be found in the level of video interactivity used for different purposes. Group research studies report that only low or medium interactivity level video is used to supplement instruction when highly interactive computer-based video programs are very effective for replacing the instruction (**1.10**, SD=1.48). PND scores somewhat support this conclusion demonstrating that students benefited from medium (**99%,** SD=1.41) and high (**87.9%**, SD=16.23) interactivity level video slightly better than from linear videos (**75.6%**, SD=26.92). Further analysis is required to draw meaningful conclusions from these findings.

Instructional design features. Highly interactive videos that included videos, pictures, texts, hyperlinks and buttons, feedback and advancing to another level based on the learner's response, and collection of performance data were used only with students without disabilities in group research studies and produced the highest effect for this population (**.74**, SD=1.04). Linear video (**1.16**, SD= .92) was more effective than the video that just raised questions, had few hyperlinks, and is available for searching (**.54**, SD= .68) for students with disabilities in group designs. The small number of students with disabilities participating in experimental studies limits the possibilities of further analysis at this time pending more coding procedures. It is interesting that students without disabilities in elementary school do much better with highly interactive video (d=1.27) than with medium and low interactive videos (d=0.48) and (d=0.12) respectively. Students with disabilities do better with linear videos (d=1.16) than with more interactive ones (d=0.50).

Single subject research studies PND scores indicate that students with mental retardation benefited greatly videos with the highly interactive videos (**88%,** SD=16.23). The small number of cases when students with mental retardation used videos with low and medium interactivity levels prevents the appropriate comparison. Students with autism were using only linear videos (**75.1%,** SD=27.81). Further analysis across grade levels or age of participants is impossible at this time due to limited information but will be conducted as more studies are added to the analysis.

Further analysis. Based on these mainly descriptive preliminary results, more detailed analysis needs to be conducted in order to find possible relationships about the above mentioned variables and other aspect of video instruction such as length, supplementary activities, subjects and the setting in the video. The analysis promises to be interesting as we attempt to find patters across students', instructions', and video interventions' components. One of the most anticipated attempts include analysis of the significantly larger effectiveness of videos featuring adults as models (**1.08**, SD=1.24) and peers without disabilities (**88.4%**, SD=12.99). Video length and intervention duration are also promising to produce exciting findings. Many more video features and its supplementary activities need to be examined.

Discussion

The present study provides the preliminary results of the meta-analysis on the efficacy of video instruction. The overall mean effect size, **.57** allows suggesting that video instruction can be relatively effective for teaching students with and without disabilities. This measure is similar to the effect size reported by McNeil and Nelson in their analysis of 63 studies across educational, military, and private sectors (**.53**). Such modest effect of video instruction on students' achievement and attitudes may be explained with the help of the anchored instruction framework. The primary goal of anchored instruction and its possible diffusion to other interactive video tools is to help students improve their abilities to accomplish goals that are more holistic, more complex than achievement measures (CTGV, 1992, 1993). Thus, the future research should look into how specifically interactive video and anchored instruction improves students' critical thinking and reasoning skills.

Video instruction proves to be slightly more effective for students with disabilities as demonstrated by both group research studies as well as the overall PND score **78.5%.** This can be the result of students with disabilities receiving more concrete video instruction with a majority of modeling and self-modeling techniques. In another context, much better performance of students with disabilities along with their general education peers on more complex problems in group research studies demonstrates one of the unique features of video instruction: the ability to close the gap between general and special populations rather than simply moving both populations equally higher up the scale (Kinzer, Gabella, & Rieth, 1994).

It is not a surprise that lower quality studies produced better results. However, this finding reveals once again that each study should be examined carefully for important methodological traits to ensure that the promisingly high results are justified.

Further analysis revealed that while age does not play a crucial role for students without disabilities, video instruction is more effective for older students with disabilities. Such findings can be explained by the cognitive load required in order to benefit from video instruction. Students have to focus their attention to benefit from such instruction. The same conclusion is supported by the notion that students didn't benefit greatly from individualized video instruction. Students' attention may drift away because of interactivity features. However, minimally interactive video may be too boring for students. More data is necessary to continue an analysis of the relationship between age, ability level, instructional areas, and video instructional design features.

This is no significant relationship between school location and the effectiveness of video instruction. That allows hypothesizing that video equipment and computers are equally available regardless of population density areas. Analysis of students' placement while receiving video instruction appeared to be limited because of the insufficient number of students with disabilities in both group and single subject research studies who were served in regular education settings. However, further analysis of the features and activities that accompanied video instruction may bring life into these data. The same is true for exploring relationship between video elements and instructional format (adjunct to existing instruction or as an independent instruction itself) as well as group deliver size

Overall, this preliminary analysis brought up more questions than answers. An analysis and conclusions are inappropriate at this time as everything may still easily change with additionally coded studies. I look forward to continue working on this line of research with great hopes for more exciting findings!

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Table 1.

Overall Effect Size for Group Research Video Instruction Studies

Studies	Mean ES	N	Std. Deviation
Comparing video instruction to conventional teaching	.6972	53	1.09319
Comparing different features within the same video instruction	.4333	46	.64343
Total	.5745	99	.91745

Table 2.

Overall Effect Sizes for Students Ability Groups in Group Research

Ability Groups	Mean ES	N	Std. Deviation
Students without disabilities	.5059	69	.78954
Students with disabilities	.9943	21	1.24003
Mixed: with and without disabilities	.1211	9	.65876
Total	.5745	99	.91745

Table 3.

Overall Effect Sizes of Video Instruction for Grade Level and Ability Category in Group Research Studies

Grade Level	Ability Category: Students without disabilities	Students with Disabilities	Mixed Group
Elementary			
Mean ES	.5761	.4238	
N	38	8	
Std. Deviation	.92733	.25567	
Middle			
Mean ES	.4139	.7800	.1211
N	18	4	9
Std. Deviation	.52845	1.23145	.65876
High			
Mean ES	.4285	5.0900	
N	13	1	
Std. Deviation	.67122		
Elementary, middle, and high			
Mean ES		1.1600	
N		8	
Std. Deviation		.92304	

Table 4.

Overall Effect Sizes and PND Scores for Different Video Instruction Implementation Models

Measures	replacement for instruction	supplement to instruction	reinforcing previous instruction
ES	.6358	.3279	.9357
N	52	28	14
Std. Deviation	1.01495	.66373	1.02367
PND	.8056		.6840
N	54		5
Std. Deviation	.24136		.25056

Appendix

Studies Included in the Meta-Analysis (divided by the groups and single subject research design)

Group Research Studies

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