Original Research Article

The Impact of Educational Video Display Styles on Elementary Students' Learning Outcomes

Qingduo Zeng

Beijing 101 High School, 11 Yiheyuan Road, Haidian District, Beijing 100084, China

ABSTRACT

After the COVID-19 pandemic, online education has gained popularity. On major video platforms, there are 2 major types of educational videos: animation (concepts are demonstrated by cartoon characters and pictures) and video with real-human presence (a recorded PowerPoint lecture). However, little research has been conducted to study which one will be better for students. Also, most of the studies about the type of educational videos used high school students and college students as their participants. There aren't many studies that select primary school kids as their participants. Therefore, considering the gap, this study aims to investigate the impact of educational video display style (animation vs. video with real-human presence) on elementary school kids. The experiment was conducted using 68 third-grade students (two classes) from an elementary school in Beijing. The two classes are randomly assigned to watch either an animation or a video with a real human presence about prime and composite numbers. Both classes are given baseline assessments before the video and posttest assessments after the video. The scores for the tests are used to measure their learning effect. The animation group showed significantly greater improvement (M = 2.52, SD = 2.37) than the real-human group (M = 1.66, SD = 2.68). Video type significantly predicted posttest scores ($b = -1.116$, $p = 0.047$, $R^2 = 0.097$). To conclude, animation might serve as a more effective type of educational video for elementary school children.

Keywords: educational video; animation; real-human presence; elementary students; mathematics learning; video display style

INTRODUCTION

With the rapid development of online education, educational videos have become an increasingly important study and teaching material. However, existing research has yet to reach a consensus regarding the impact of animated videos versus live-action videos on learning outcomes. Some studies support the advantages of animated videos (1, 2), while others suggest no significant difference between the two formats (3).

Recent research has primarily focused on adult and high school students, while studies of elementary school students remain limited. Younger elementary school students' cognitive development, attention span, and media preferences differ from those of adults and high school groups. Children in this age group typically fall into the Concrete Operational Stage, according to Piaget's developmental stages theory, characterized by the heavy reliance on visual imagery and the demonstration of a natural preference for animated content.

This study compares the effects of two video

Corresponding author: Qingduo Zeng, E-mail: zengqingduo2008@163.com.

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display styles, animation and real-human presence, on third-grade students' mathematics learning outcomes, providing empirical evidence to optimize educational video design for children.

LITERATURE REVIEW

Overview of Online Learning and Educational Videos

In an increasingly interconnected world with widespread internet access, online education and video-based courses gained significant prominence following the COVID-19 pandemic, when students had to stay at home to study. Online teaching refers to education being delivered in an online environment through the use of the internet for teaching and learning. This includes online learning on the part of the students that is not dependent on their physical or virtual co-location. The teaching content is delivered online, and the instructors develop teaching modules that enhance learning and interactivity in the synchronous or asynchronous environment (4).

On the one hand, online learning provides students with several opportunities and benefits. Online learning provides students with autonomy and flexibility in their learning (5). Also, online learning provides a friendlier environment for high school students, especially those who may feel uncomfortable speaking up in crowded classrooms, allowing them to freely express themselves, including asking questions of their teachers (6).

On the other hand, there are also challenges involved in online learning. From the teachers' perspective, maintaining student engagement in online environments can be more difficult than in face-to-face classrooms (9). Therefore, teachers need to devote more effort to course preparation and teaching. Moreover, from the students' side, since students can organize their time themselves, it "highlights the demand for self-discipline and motivation from learners who navigate their studies without the physical structure of a classroom," as Culduz (2024) pointed out (9). For students who lack self-discipline or have certain mental disorders, online learning can be particularly challenging. Take students with attention deficit hyperactivity disorder (ADHD), for example. Adolescents with ADHD experienced significantly more difficulties with remote learning than adolescents without ADHD (10).

However, educational videos and video courses might be a promising tool in online learning. In a study conducted at the University of British Columbia, Canada, researchers analyzed the clickstream data of 387 undergraduate students and found that those in the online course showed much more strategic and adaptive use of video than those in blended courses (11). Seo et al. [2021] attribute the phenomenon to the adaptation of students to the expectations of the instructor, the role of the video in the class, and the affordances of the video player, shaping students to be more efficient and focused (11).

Additionally, educational videos designed with interactive quizzes, clickable hotspots, and branching scenarios could enhance learning, as evidenced by research conducted by Haerawan, Cale, and Barroso [2024] (12). Their research lasted 12 weeks, involving 300 undergraduate students. They found a significant increase in student engagement for the interactive video group, with 45% higher interaction rates and 30% longer viewing times than the control group.

Video Presentation Styles: Animation and Real-human Presence

Generally speaking, educational videos can be categorized into two types: animation and real-human presence videos.

Animation videos lead to encouraging results in students' learning. A few studies comparing animations to static visualizations have implied that animation types of educational videos are more effective (1). Bilginer and Uzun (2022) compared slow-motion animation with visual materials in teaching the circulatory system (13). The study was performed at Kahramanmaras Sutcu Imam University in Turkey, using 34 preservice science teachers (18 in the animation group and 16 in the visual material group). They found that students in the animation group achieved significantly higher rates of correct models and correct explanations than those in the visual material group, once again demonstrating the superiority of animation-based instruction.

Meanwhile, previous studies about real-human presence educational videos also generated appealing results. Real-human presence educational videos typically refer to talking-head formats (instructor visible, sometimes picture-in-picture, delivering a PowerPoint lecture). Today, whether real-human presence video is a beneficial presentation style is not agreed upon among scholars. Some researchers claim a worse learning outcome for real-human presence videos, while participants rated their perceived learning higher for those videos with a talking head (2).

By contrast, other studies present different perspectives. For example, Marx and König [2025] found no significant difference in knowledge understanding effectiveness or audience willingness to share content between videos featuring live presenters and animated videos, which suggests both formats are equally effective in science communication (3).

Online Learning and Video Use for Elementary Students

Compared to teenagers and adults, online learning has been more challenging for elementary school students. They are not "mini adults." Rather, a large gap in mental development and self-regulation exists between children and adults.

As Johnson et al. [2023] suggested, nineteen (7%) of the articles reviewed indicated that the developmental levels of younger K–12 students can create barriers to success in virtual K–12 learning (6). Compared to adults, poorer sustained attention and greater distractibility and impulsivity compared to adults (7). Therefore, the display style of the course needs to be meticulously chosen to attract children, corresponding to "age-appropriate expectations for children's attention spans (6)."

Furthermore, compared to grown adults, children are more attracted to and engaged by animation. In an experimental study conducted at the University of Wisconsin-Madison with approximately 92 preschool children aged 3–5, Snyder and Mares [2021] had children watch static pictures featuring either animated characters or real humans presenting the same educational content (14). They found that children show higher levels of attraction, retention motivation, and selection of animated formats as informative, compared to real-human presence videos. Children have a natural tendency toward animated characters and information. They tend to choose animated characters as better informants for a variety of lesson domains. Children showed little sign of prioritizing realism; they like animations more. Another group of scientists argues that students (grades 3–6 focus) exposed to animation-based teaching methods exhibit higher levels of attention retention, better reproduction of learned material, and increased motivation compared to those following traditional teaching methods (15).

Elementary Students, Math, and Examination

This study applied a video about elementary math as one of the materials. Compared to other subjects, such as language (Chinese or English) and science, math has its unique advantage in measuring elementary students' learning outcomes.

First, math knowledge has clear boundaries between concepts, which makes it advantageous for the objective measurement of students' learning. The Ministry of Education of the People's Republic of China (MOE) established clear requirements and guidelines for what should be taught in math at different age levels. According to Pedon and Grover [2025], math learning involves knowledge, comprehension, and application, which are accessible for using tests to measure (16). Through tests, quantitative data can be collected to indicate students' learning effects.

Second, math is relatively decontextualized, which requires less of students' language ability, thereby contributing to lowering the group difference in the study. Math learning is mostly about logic. Mathematical communication is more than vocabulary. While vocabulary is necessary, it is not sufficient. Learning to communicate mathematically is not merely or primarily a matter of learning vocabulary (17). Therefore, by choosing math as the content displayed in both videos, the confounding brought by differences in language abilities can be minimized, enabling a purer measurement of students' understanding of the knowledge itself.

1.5 Gaps in Literature and Contribution of the Current Study

In previous studies, there are limited comparative studies on video styles. Currently, there is still no consensus among scholars about which display style is more helpful for learning. Some scholars support the promotion of animated educational videos since they convey knowledge efficiently due to the integration of visual and auditory modalities (1, 13). Sondermann and Merkt [2023] also argue that real-human presence videos could undermine learning, even though they enhance learners' subjective satisfaction and perceived learning (2). Nevertheless, scholars represented by Marx and König suggest that animation and real-human presence video produce the same results in teaching a lesson (3). Such variations could be caused by various factors, such as age and the quality of the video. More research is needed to compare the benefits that students gain from both video display styles.

In addition, most studies focus on adults (2, 3), and youth (5, 8) participants to date. Notably, no study has systematically examined the impact of video display style on a younger population: elementary school children. Elementary school children's cognitive development, concentration duration, and ability to perceive media vary tremendously from those of youth and adults. Thus, their perception of visual cues and smiles in educational videos will also differ from that of adults. This gap constitutes the central motivation for the present study.

Hypothesis

Considering elementary school children's mental development and the type of media they favor, it is reasonable to assume that an educational video displayed as animation will benefit the children more than a real-human presence video. Students who watch animated educational videos will demonstrate greater learning gains than those who watch real-human presence videos.

METHODS AND MATERIALS

Procedure

This study employed a quasi-experimental cluster design, in which intact classrooms rather than individual students were randomly assigned to conditions. First, two classes were randomly selected from all third-grade classes in the school through a class-level draw, and then randomly assigned to conditions (animation vs. real-human presence) through a coin flip. Specifically, Class A was assigned to the animation group, and Class B was assigned to the real-human video group. Then, the baseline assessment was distributed to the students. They were given 10 minutes to finish the assessment. After 10 minutes, the test papers were collected. The baseline assessments were identical for both the animation and real-human video groups. Immediately after, the educational video was played for the students. The animation version was played for students in the animation group, and the video recording of a PowerPoint lecture was played for students in the real-human video group. Following the video presentation, students completed a second assessment, the posttest. The students were again given 10 minutes to finish the assessment. The post-test assessments were then collected. The content of the post-test assessment was also identical between the two groups. Finally, all the assessments were later graded, and the scores were recorded for statistical use. Thus, the only experimental manipulation between the two groups was the type of video presentation: animation or real-human presence.

Participants

Two third-grade classes from an elementary school in Beijing, China, were selected as the participants for the study. Only the students who enrolled in one of the two classes and were present on the video display day will be included in this study. Students who have already demonstrated a deep understanding of the topic will participate in the activity, but their data will later be removed. The specific evaluation methods will be discussed in detail later in this paper in part 2.4. This study obtained permission from the elementary school, and the Institutional Review Board approved a waiver of parental consent due to local cultural norms and the minimal-risk nature of the study.

Based on the class grouping allocation, the 31 students from Class A were assigned to the Animation Group, while the 35 students from Class B were assigned to the Live-Action Group. The gender distribution between the two groups was similar: 13 males and 20 females in the animation group and 16 males and 19 females in the real-human video group. All students were given an assent to sign before the baseline assessment and are explained what the study is about. The scores that the students scored won't be published, ensuring confidentiality.

Materials

The main study materials for this study are two educational videos about prime numbers and composite numbers. As mentioned before, all the participants involved in the study are third-grade students. Normally, according to the Mathematics Curriculum Standard for Compulsory Education (2022 Edition) (18), elementary students will not learn about prime numbers and composite numbers in math classes until 5th grade, which in turn ensures that all students are learning knowledge they never learned before, further minimizing the baseline gap between groups.

One of the two is an animation, explaining concepts through cartoon characters, animations, and voice-over narration, and a screenshot from the animation shown to the students is displayed below in Figure 1. The other is a video with real human presence, and a screenshot

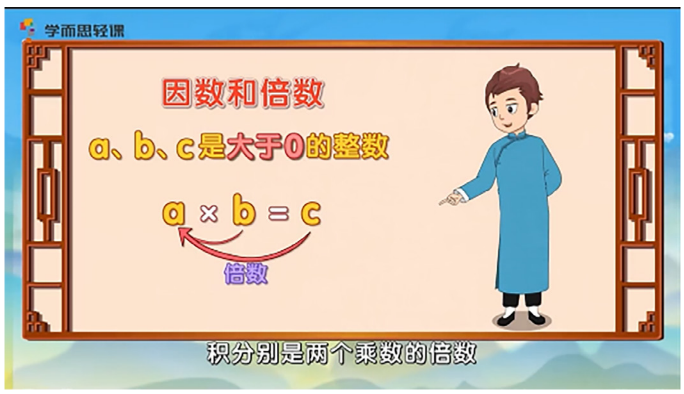

Figure 1. *Screenshot of the animated educational video (animation group). Concepts are delivered through cartoon.*

from the video with real human presence is shown to the students in Figure 2. The video records the PowerPoint lecture of a teacher who appears most of the time in the video. The two videos were found online and edited to ensure they have similar lengths and deliver identical concepts. Originally, there were inconsistencies between the two videos: one video gave an example that the other did not. Hence, inconsistent content between the two videos was eliminated to ensure both videos are of equal length (11–12 minutes) and deliver the same content.

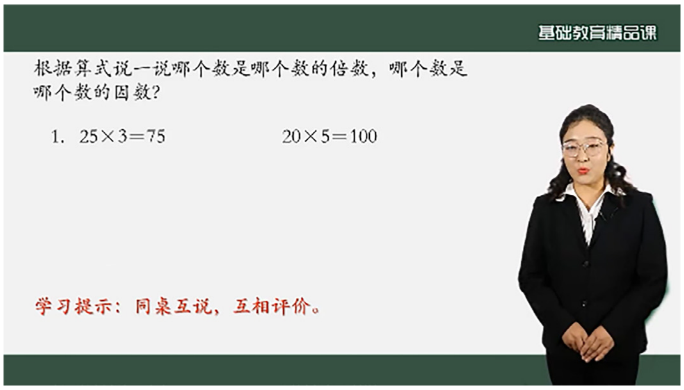

Figure 2. *Screenshot of the real human presence video (real human group) Concepts are delivered through PowerPoint lecture.*

The other material that is crucial to the study comprises the baseline assessments and posttest assessments. Baseline assessments aim to test students' prior knowledge about prime numbers, while the posttest aims to test students' learning after watching the video. The contents of the tests were checked by a math teacher at the elementary school, ensuring that all the wording and questions were understandable to elementary school children. The baseline assessment and posttest assessment test the same knowledge but with different questions. Both assessments mimic the wording and tone of a third-grade math test provided by the elementary school math teacher so that students can better understand it.

There are 3 multiple-choice questions and 4 fill-in-the-blank questions for both tests, with a maximum of 10 points. Question 2, which asks the student to write all the factors for a composite number, is worth 4 points in both tests. One point is awarded for each factor listed, up to a maximum of four points (the numbers whose factors are to be written in both questions have only 4 factors). No points will be awarded for listing additional factors. The rest of the multiple-choice and fill-in-the-blank questions are all worth 1 point.

Both test papers (baseline assessments and posttest assessments) cover four core concepts: multiples, factors, prime numbers, and composite numbers, all of which are mentioned in both the animation and real-human presence videos. Each concept is distributed evenly across tests (1–2 questions each) in a different sequence. Specifically, Questions 1 and 5 on the baseline assessment and Questions 1 and 6 on the posttest assessment both test the concept of multiples; Questions 2 and 6 on the baseline assessment and Questions 2 and 7 on the posttest assessment both test the concept of factors; Questions 3 and 7 on the baseline assessment and Questions 4 and 5 on the posttest assessment both test the concept of prime numbers; Question 4 on the baseline assessment and Question 3 on the posttest assessment both test the concept of composite numbers.

Data Processing

Both tests are scored out of ten points, with one point awarded for each correct answer. All students' scores for the baseline assessment and posttest assessment were recorded in a Microsoft Excel file. Students' improvement scores were then calculated (posttest assessment score minus baseline assessment score).

According to the box plot shown in Figure 3 of the original data for each group, any student scoring 10 points (full marks) on the baseline test was considered

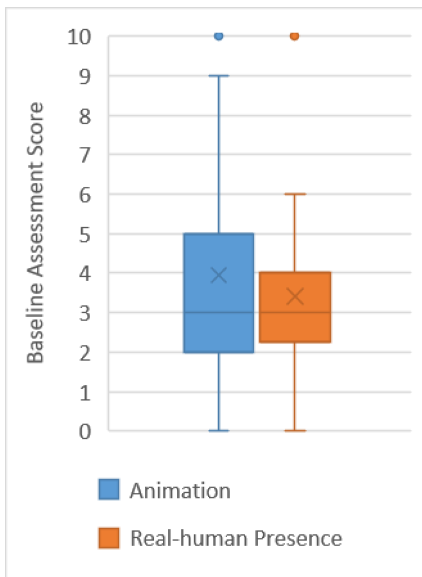

Figure 3. *Box Plots of Baseline Assessment Scores by Group for Outlier Identification (10 points for full marks).*

to have sufficient understanding of the relevant knowledge covered in the video. Including these cases could potentially introduce bias into the analysis. Consequently, their data were removed as outliers in the final data processing and statistics. In total, 3 outliers were removed from the data set (2 from the animation group and 1 from the real-human video group).

A name list with gender information for both groups was obtained from their homeroom teacher. Students' gender information was also recorded in the Excel file for later statistics.

Further statistical analyses were conducted using Jamovi, including descriptive statistics, t-tests, Pearson's correlation, and regression. Descriptive statistics were generated to summarize the mean, standard deviation, and range of pretest and posttest scores for each group. T-tests assessed baseline equivalence between groups and the significance of the baseline-to-posttest changes. Pearson's correlation examined the strength and significance of the relationship between the condition (animation vs. real-human presence video) and posttest scores. Regression tested whether the condition significantly predicted posttest performance.

Variables

The primary independent variable was group assignment, with students in the animation condition coded as 0 and students in the real-human presence video condition coded as 1. Gender was included as a demographic variable and was coded as 0 for males and 1 for females. The primary outcome measures were students' baseline assessment scores and posttest assessment scores, both of which ranged from 0 to 10 points. Baseline assessment scores were used to evaluate prior knowledge and group equivalence before the intervention, while posttest assessment scores were used to measure learning outcomes following video exposure.

RESULTS

Based on comparisons of baseline and posttest scores, as well as correlation and regression analyses, the following results were obtained.

Baseline Characteristics and Descriptive Statistics

There are 33 students in the animation group (13 males and 20 females) and 35 students (16 males and 19 females) in the real-human video group. The two groups (animation video group and real-human video group) started at almost the same level: they have similar mean test scores on the baseline tests (3.58 points for the animation group and 3.23 points for the real-human presence video group) and identical medians (3.00 for both groups). After watching the video, the animation group obtained a higher score (mean score 6.09 points, median 6.00 points) than the real-human video group (mean score 4.89 points, median 5.00 points). The animation group also made greater improvements, measured by posttest score minus baseline test score (Δ Score), than the real-human video group. The animation group has a mean Δ Score of 2.52 points and a median Δ Score of 2 points, while the real-human group has a mean Δ Score of 1.66 and a median Δ Score of 2 points (Table 1).

Group Comparisons and Learning Gains

Table 2 shows the result of an independent sample t-test of the baseline test scores of the two groups. The result, again, shows that the two groups started at the same level. The scores of the two groups showed a small difference ($t = 0.896$), and the difference was not statistically significant ($p = 0.373 > 0.05$), verifying a balanced and reasonable grouping. This effective grouping allows future observed differences to be more reasonably attributed to the experimental intervention.

Table 1. *Descriptive statistics of baseline assessment scores, posttest assessment scores, and learning gains (Δ Score = posttest minus baseline) for the animation group (n = 33) and real-human presence video group (n = 35). Values are reported as mean (M), standard deviation (SD), median, and range. All assessment scores ranged from 0 to 10 points.*

	Animation (13 males and 20 females)			**Real-human (16 males and 19 females)**		
Variable	***M(SD)***	**Median**	**Range**	***M(SD)***	**Median**	**Range**
Baseline Assessment	3.58(1.89)	3	5	3.23(1.26)	3	6
Posttest Assessment	6.09(1.79)	6	7	4.89(2.65)	5	10
Δ Score (Posttest-baseline)	2.52(2.37)	2	8	1.66(2.68)	2	10

Table 2. *Results of the independent-samples t-test comparing baseline assessment scores between the animation group and the real-human presence video group. No statistically significant difference was observed between groups prior to the intervention (p = 0.373), indicating comparable baseline knowledge levels.*

	Statistic	df	*p*
Baseline assessments	0.896	66.0	0.373

Note. df = degrees of freedom.

Table 3. *Results of the paired-samples t-test comparing baseline and posttest assessment scores within the animation group (n = 33). Students demonstrated a statistically significant improvement following exposure to the animated educational video (p < 0.001), with a large effect size (Cohen's d = 1.06).*

	Statistic	df	*p*	Effect Size
Student's *t*	6.09	32.0	<.001	1.06

Note. H_a μMeasure 1 - Measure 2 > 0, Measure 1 = posttest score, Measure 2 = baseline score. Cohen's d is the effect size.

Table 4. *Results of the paired-samples t-test comparing baseline and posttest assessment scores within the real-human presence video group (n = 35). Students demonstrated a statistically significant improvement following exposure to the real-human presence educational video (p < 0.001), with a moderate effect size (Cohen's d = 0.619).*

	Statistic	df	*p*	Effect Size
Student's *t*	3.66	34.0	<.001	0.619

Note. H_a $\mu_{\text{Measure 1 - Measure 2}}$ >0, Measure 1 = posttest score, Measure 2 = baseline score. Cohen's d is the effect size.

Then, as shown in Table 3 and Table 4, paired sample t-tests were separately conducted on the two groups' data sets, comparing baseline assessments and posttest assessments for both groups. In both charts, Measure 1 refers to the posttest assessment and Measure 2 refers to the baseline assessment. For the animation group, the improvement made after watching the video is statistically significant (p < 0.01), showing that the difference between the baseline test and the posttest assessments did not occur due to chance. For the real-human video group, the improvement made after watching the video is also statistically significant (p < 0.01), showing that the difference between the baseline test and the posttest assessments did not occur due to chance. Both video display styles can effectively enhance learning (Cohen's d for the animation group is 1.06, and Cohen's d for the real-human video group is 0.619).

Correlation Analysis

To further discuss the relationship between the variables, Pearson correlations were conducted, as shown in Table 5. According to the correlation matrix, there is a negative correlation between Group and Posttest assessments (r = -0.259). This relationship is statistically significant (p = 0.033 < 0.05), suggesting a significant result that different video types might impact students' learning, and the animation seems to benefit the students more.

Moreover, there was a weak positive correlation between group assignment and gender (r = 0.028), which was not statistically significant (p = 0.822 > 0.05), indicating that gender was evenly distributed across groups. There was also no significant relationship between group assignment and baseline assessment (r = -0.110, p = 0.373 > 0.05), confirming that pre-existing

Table 5. *Pearson correlation matrix showing relationships among group assignment, gender, baseline assessment scores, and posttest assessment scores (n = 68). Group was coded as 0 = animation and 1 = real-human presence video. A statistically significant negative correlation was observed between group assignment and posttest scores (r = −0.259, p = 0.033), indicating higher posttest performance in the animation group.*

		Group	Gender	Baseline assessments	Posttest assessments
Group	**Pearson's r**	—			
	p	—			
Gender	**Pearson's r**	0.028	—		
	p	0.822	—		
Baseline assessments	**Pearson's r**	-0.110	0.106	—	
	p	0.373	0.389	—	
Posttest assessments	**Pearson's r**	-0.259	0.013	0.201	—
	p	0.033	0.913	0.100	—

differences in the content knowledge were minor across groups.

Additionally, a weak positive correlation existed between gender and baseline assessment (r = 0.106, p = 0.389 > 0.05), as well as between gender and posttest assessment (r = 0.013, p = 0.913 > 0.05). Neither was statistically significant. The correlation between baseline and posttest assessments was not statistically significant (r = 0.201, p = 0.100 > 0.05). This relationship suggests that pre-existing differences in content knowledge were unlikely to account for the observed posttest differences between groups, though the absence of a significant correlation alone is insufficient to establish causation

Regression Analysis of Posttest Performance

Table 6. *Overall model fit statistics for the linear regression analysis predicting posttest assessment scores (n = 68). The model explained 9.7% of the variance in posttest performance ($R^2 = 0.097$).*

Model	R	R^2
1	.312	.097

Note. Models estimated using a sample size of n=68, R=multiple correlation, R^2=coefficient of determination

Table 7. *Linear regression coefficients predicting posttest assessment scores from baseline assessment scores and group assignment. After controlling for baseline performance, students in the real-human presence video group scored significantly lower than those in the animation group (b = −1.116, p = 0.047).*

Predictor	b	SE	*t*	*p*
Intercept [a]	5.173	0.736	7.03	< .001
Baseline Assessment	0.257	0.174	1.48	.145
Group:				
1-0	-1.116	0.551	-2.03	.047

As shown in Table 6 and Table 7, based on the significant Pearson correlation model that shows a significant relationship between Group and Posttest assessment, a linear regression analysis was conducted to further explore the impact of different video display styles on students' learning. The linear regression model uses posttest assessment as the dependent variable, groups as the factor, and baseline assessments as the covariate. The model was estimated using a sample size of N = 68.

This result accounts for 9.7% of the variance in posttest scores ($R^2 = 0.097$). According to the results, the real-human presence video group scored 1.116 points lower on average compared to the animation group (B = -1.116, t = -2.03). The linear regression model is statistically significant (p = 0.047 < 0.05), showing that different video display styles have an impact on students' learning outcomes independent of other variables. The animation group performed better than the real-human presence group. As a result, for elementary school children, it would be better if the knowledge in the educational video were delivered in an animation style.

The impact of baseline assessment on posttest is not statistically significant (B = 0.257, p = 0.145>0.05) suggesting that prior knowledge levels were not a statistically significant predictor of posttest performance in this sample. Thus, this may indicate that the effectiveness of video display style is, to some extent, independent of students' prior knowledge base.

DISCUSSION

Interpretation of Findings

Taken together, the various quantitative analyses yield consistent conclusions: in the post-test, the animation group has a better performance in learning the concepts shown in the video compared to the real-human presence group, and this advantage persisted even after controlling baseline performance factors.

Considering the former studies, the result that students have a better performance after watching aligns with Bilginer and Uzun [2022], who found animation-based instruction superior to visual materials in a science context (13). However, the results differ from Marx and König [2025]'s finding that there is no significant difference in learning effects between animation and real-human presence video in teaching a lesson (3). Though with consistencies and inconsistencies with prior research, this study extends the population to a younger age.

Potential Mechanisms and Explanations

These findings may be explained by children's strong preference for animated content. According to research by Snyder and Mares [2021], children tend to choose animated characters over real human characters as their preferred informants for learning across a variety of lesson domains (14). Since animations attract children better, which counterbalances their lack of attention and self-regulation, it is plausible that children learn more from educational videos displayed as animations.

Besides their preference, elementary school students' cognitive development may account for the result as well. 8–9-year-old elementary students are in the early stages of concrete operational thinking, relying more heavily on visual imagery. According to Adil et al. [2025], fourth-grade students are in a critical developmental period characterized by Piaget as the transition from concrete operational thinking to abstract reasoning (19). Animation visualizes abstract math terms and concepts in a way that is more perceptible to elementary school children than real-human presence videos. As such, educational videos that are more visually based compared to real-human presence videos could be easier for children to understand, leading to a better learning effect.

In addition, some scholars provide potential explanations for why real-human presence videos help students less. Among the potential theories is the split-attention principle (20), which states that learning materials that require learners to split their attention can increase extraneous cognitive load and therefore hinder learning. When explaining their results, Sondermann and Merkt [2023], who discovered that although participants rated their perceived learning higher for real-human presence videos, they had worse learning outcomes, note that the visible instructor can distract learners from the actual learning content, leading to poorer learning outcomes despite higher subjective ratings (2).

Study Limitations and Future Directions

The study applied cluster sampling, randomly choosing two classes among all the classes in the third grade of an elementary school to be the participants, rather than random sampling. Cluster sampling might lead to greater error compared to random sampling because the impact on the result caused by differences between individuals cannot be fully eliminated through cluster sampling, though no significant difference was observed between the two classes chosen for this study ($p = 0.373$).

Also, due to local norms, considering the reputation of the elementary school, parents weren't given informed consent in this experiment. What the elementary school worried about was not the academic value or the fear of improper content's appearance. Rather, they are concerned about the potentially unpredictable reactions from parents. In China, parents' opinions and feedback are extremely influential to the school's reputation. Therefore, any request for formal consent from the parents, though the research itself has low risk and is considered harmless, is regarded as opening a potential channel for complaints and negative feedback. The school's priority is to avoid any scenario that might generate public sentiment risk, which is the main concern for Chinese schools.

Furthermore, there are limitations in assessments. Since posttest assessments were conducted immediately after the video display for both groups, the result shows the immediate impact of the video display style on students. Granted, due to the lack of long-term measurement, whether animation will benefit the students' understanding of knowledge in the long run remains uncertain. Because this study also didn't include any questions to measure the level of attractiveness of different video display styles and the level of concentration of students when they were completing the test, the possible explanations mentioned in section 4.2 are all inferences based on past studies, waiting for further confirmations in future studies. Future studies should include delayed tests to examine the durable gain they derived from different video display styles and include measurements of students' engagement.

Last, although a significant relationship between video type and posttest assessment was found among students, the effect size was modest: Pearson's $r = -0.259$ ($p = 0.033$) indicates a weak-to-moderate correlation, and the regression model explained only 9.7% of the variance in posttest scores; in the linear regression, video display style showed a statistically significant predictive ability for students' learning outcomes ($B = -1.116$, $t = -2.03$, $p = 0.047$). The research has a relatively small sample size, and the samples were selected from one elementary school, which might be the potential reason for the weak relationship. If more participants are included in future studies, a stronger result could be derived.

CONCLUSION

This exploratory study preliminarily examined the impact of different video presentation styles on elementary students' mathematics learning outcomes. Despite methodological limitations, including the use of cluster rather than random sampling, a small single-school sample, and the absence of a measure of student engagement during video viewing, results indicate that students in the animation group demonstrated greater progress than those in the live-action group, and video type significantly predicted posttest scores. Future studies should replicate the whole study process with a broader population: apply random sampling from multiple schools in different regions. Also, the future study should get parental consent, ensuring all the ethical requirements for the experiment are met.

The findings of this research carry practical implications for educators and designers of educational content. When designing educational videos for elementary school kids, animations are more advantageous for children to have a better understanding of the concepts compared with videos with a real human presence, especially when it comes to subjects such as math that require abstract thinking. Those who wish to use educational videos as a teaching material should select the corresponding video display style based on students' age and cognitive development.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

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