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Original Article

The Impact of Interactive Micro-Video–Based Learning on Elementary Students' Knowledge, Attitudes, and Skills in Personal Health Education

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ABSTRACT

Background: Teaching health and self-care during childhood is essential for promoting long-term well-being. As digital education becomes more prevalent, interactive micro-videos have shown potential as an engaging tool to improve students' health knowledge and literacy. This study aimed to evaluate the effectiveness of interactive micro-video–based instruction on elementary students' knowledge, attitudes, and personal health skills.

Methods: A quasi-experimental study employing a pre-test post-test design with a control group was carried out from September 2022 to January 2023 in a boys' elementary school located in Tehran, Iran. Thirty-eight 6th grade students were randomly assigned to either an intervention group (n=19), receiving six sessions of personal health education via interactive micro-videos, or a control group (n=19), receiving conventional instruction. A researcher-developed 40-item questionnaire was validated through expert review (CVI=0.85) and reliability testing (Cronbach's α=0.74–0.90). Data were analyzed using SPSS V.22, including descriptive statistics, independent and paired samples t-tests, and non-parametric alternatives (Mann–Whitney U and Wilcoxon signed-rank tests) where appropriate.

Results: Baseline comparisons showed no significant differences between groups in age or access to digital devices. Post-intervention analysis revealed significant improvements in the intervention group in knowledge and personal health skills ($P<0.001$), while changes in attitude were not statistically significant. Gain scores confirmed a strong effect of the micro-video intervention, particularly in knowledge acquisition.

Conclusion: Interactive micro-video instruction significantly enhanced students' health-related knowledge and skills. The integration of multimedia design principles offers a scalable and effective strategy for school-based health education, especially in contexts requiring flexible and engaging learning formats.

Keywords: Health Education, Audiovisual Aids, Knowledge, Attitude, Self Care, Elementary School, Students

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Introduction

Today, schools serve as centers that connect families, educators, and stakeholders to deliver not only education but also enrichment opportunities, health services, and social support for students. Collaboration between schools and communities results in numerous benefits, enabling students to serve as health ambassadors who promote healthy behaviors within their families and wider communities (1).

Students are a key segment of society, and safeguarding their health is essential. When their health literacy is strengthened, they develop the skills and motivation needed to adopt healthier habits and prevent illness, ultimately lowering healthcare expenses. Conversely, limited health literacy is linked to harmful behaviors—such as unhealthy eating, physical inactivity, and smoking—that elevate the risk of chronic conditions like cardiovascular disease, obesity, hypertension, and diabetes later in life. Evidence indicates that educational programs can significantly enhance students' health literacy and overall well-being (2).

Students, as a vulnerable population, hold a unique position within families and therefore require targeted attention in health initiatives. Childhood is a critical period in which foundational health habits are shaped, making early health education a major predictor of long-term wellbeing. Effective school-based health instruction can strengthen public health, promote positive lifestyle behaviors, and reduce the likelihood of antisocial tendencies. Conversely, insufficient health education can contribute to serious outcomes, including cardiovascular, oral, mental, and metabolic disorders. Accordingly, school health professionals have a vital responsibility in fostering students' health and providing support to families who may be at greater risk (1, 3).

Health education and promotion are important factors in economic, social, and individual development. Achieving health and crisis awareness requires structured and continuous training (3). Yet, research shows that relying solely on textbook materials is insufficient to meet students' health-related learning needs, highlighting the necessity for schools to extend their instruction beyond traditional texts (4).

Health education in schools has advanced with the adoption of modern technologies and multimedia resources. Today's students tend to be more engaged with mobile- and computer-based learning formats (5). However, conventional instructional methods, gaps in teachers' health literacy, and outdated textbook materials underscore the necessity for innovative and effective health-education strategies. Because schools have a direct impact on children and an indirect influence on families and communities, strengthening health education at the primary level is one of the most practical avenues for improving public health (6).

As technology continues to advance, interactive features have become a key component of modern learning environments. Digital tools now enable meaningful collaboration and communication between teachers and students, making it possible for learners in various locations to participate in joint activities and share information (7). A technology-based learning environment enables people to interact and enrich their learning experiences (8). Multimedia is considered one of the most powerful types of information and communication technology, combining elements such as text, visuals, audio, music, video, and animation, typically delivered through computer-based tools (9).

Given the substantial influence of Information and Communication Technology (ICT) on learning, many educational systems have integrated ICT to enhance instructional quality and student achievement. Within these ICT-driven methods, multimedia instruction enables learners to engage with content through multiple formats and interactive interfaces (10).

The 9th World Conference on Health Promotion (Shanghai, 2016), hosted by the WHO in collaboration with the Chinese government, highlighted health promotion

as a crucial component of the United Nations Sustainable Development Goals (SDGs). Among these goals is the commitment to ensure that students acquire the knowledge and competencies needed for sustainable development. Though enhancing health literacy through school-based health education presents difficulties, it remains vital for enabling students to maintain healthy behaviors across their lifespan (11).

Differences in teaching quality, unequal access to teachers, and limited classroom interaction have encouraged educators to use multimedia methods to unify and enhance students' learning of knowledge, attitudes, and skills (12). Technology can enhance students' competence, and multimedia-based learning has been proven to improve students' knowledge and health skills (13).

Previous studies corroborate these findings. Mayer reported that multimedia learning—when designed according to cognitive principles—can significantly enhance students' understanding and memory retention, especially in science and health-related subjects. Mayer argues that learning outcomes are not determined by the medium itself, but by the instructional methods applied (14). Similarly, Le Rossignol emphasized that multimedia and blended learning environments—when designed effectively—can enhance students' academic performance and engagement, particularly in higher education settings (15). Taghipour and colleagues (2023) demonstrated that gamified multimedia education significantly improved adolescents' awareness and attitudes toward substance abuse prevention, including hallucinogenic substances (16). The World Health Organization (2003) emphasized that multimedia is a valuable tool for health education and should integrate knowledge, attitudes, and skills (17).

Shah and colleagues (2015) concluded that multimedia-assisted education enhances students' academic achievement and attitudes, especially at the elementary level, fostering a constructivist learning environment where learners play an active role. Therefore, teachers should be encouraged to use multimedia to accommodate different learning styles and promote positive attitudes (18). With the rise of virtual learning environments, multimedia has become increasingly accessible, and students themselves express interest in more multimedia use in their learning (19).

Due to technological advances and occasional crises that disrupt in-person classes, combining technology with face-to-face instruction can increase flexibility, enable learning anytime and anywhere, and reduce educational costs. Modern research seeks to use technology not only to simulate face-to-face learning but to improve its quality and overcome its limitations (20).

Accordingly, the present study aimed to investigate how interactive micro-video–based instruction in personal health skills influences elementary students' knowledge, attitudes, and practical abilities.

Methods

Study Design and Setting

This study employed a quasi-experimental method with a pre-test post-test design and a control group. It was carried out between September 2022 and January 2023 at a boys' elementary school in Tehran, Iran.

Participants and Sampling

The study population comprised 45 male sixth-grade students from Bahonar Primary School, a boys' elementary school in Tehran, Iran. Seven students did not complete the post-tests, leaving a final sample of 38 participants. Based on the mean and standard deviation reported in a previous quasi-experimental study by Moazami and colleagues (21), the effect size was estimated at 0.66. Using the standard formula for comparing two independent means with $\alpha=0.05$ and power=0.80, the minimum required sample size was calculated to be approximately 18 participants per group. In this study, all 38 students from one sixth-grade class at Bahonar Primary School were included and randomly assigned to two groups: the educational intervention group and the control group.

Accordingly, 19 students were allocated to the intervention group and 19 to the control group. Sampling was carried out using a simple random method through a lottery procedure.

The inclusion criteria comprised students aged 10 to 12 years who demonstrated normal physical and cognitive health, had access to digital devices and Internet connectivity, obtained parental consent, agreed to take part, and were able to attend all scheduled training sessions. Students were excluded if they missed more than 20% of the sessions, provided incomplete or inconsistent questionnaire data, lacked the necessary technological resources, experienced health or personal issues that interfered with participation, or produced irregular or invalid data.

Intervention/Procedures

The educational program was designed using an approved instructional resource and validated by a health and wellness specialist from the Department of Education, Region 9, Tehran, Iran. It included six sessions, each lasting 25 minutes. A comprehensive summary of the course content is provided in Table 1.

Before instruction began, the researcher conducted an initial orientation session for all students in the selected class. Following this, the pre-test was administered to introduce and review the relevant topics. After completing the six instructional sessions, the post-test was administered and the results were analyzed.

Interactive Micro-Video

An interactive micro-video was designed by the researchers and subsequently approved by the relevant department of education. The video centered on personal health practices at home and at school, addressing subjects such as eye and ear care, infectious disease awareness, prevention strategies, transmission pathways, key symptoms, and treatment options. Its content was aligned with the most recent recommendations from the Ministry of Health, Treatment and Medical Education, as well as the World Health Organization.

The micro-video's design was informed by Mayer's (2003) cognitive theory of multimedia learning, which highlights that instructional messages aligned with the way people process information promote deeper learning. Mayer and Moreno's three core hypotheses regarding human learning served as the foundation for constructing the multimedia instructional approach (22).

The micro-video integrates Mayer's seven multimedia design principles: the Multimedia Principle, the Spatial Contiguity Principle, the Temporal Contiguity Principle, the Coherence Principle, the Modality Principle (Sensory Channels), the Redundancy Principle, and the Individual Differences Principle.

Table 1: Details of the training sessions

Meeting	Content	Target	Interactive micro-video	Time
First	Introduction	Providing an overview of the research goals and collecting consent documents from students and their parents	Completing the pre-test	25 min
Second	Personal hygiene at home and school	Familiarity with the principles of personal hygiene and its implementation methods at home and school	Using interactive micro-video to teach personal hygiene skills	25 min
Third	Eye care	Familiarity with eye care methods and diseases related to them	Using interactive micro-video to teach personal hygiene skills	25 min
Fourth	Caring for the ears	Familiarity with eye care methods and diseases related to them	Using interactive micro-video to teach personal hygiene skills	25 min
Fifth	Familiarity with infectious diseases	Familiarity with infectious diseases, prevention and ways of transmission, symptoms and treatment	Using interactive micro-video to teach personal hygiene skills	25 min
Sixth	Further Details	Post-test implementation	Post-test	25 min

These principles were applied collectively to enhance student engagement, comprehension, and meaningful learning in personal health topics for elementary school students (14, 22).

Tools/Instruments

The present study followed a rigorous, multi-step procedure to develop and validate a researcher-designed questionnaire intended to assess elementary students' health-related knowledge, attitudes, and skills.

First, an initial set of items was created through an extensive review of the literature and semi-structured interviews with 10 experts in health education. These experts—comprising educators and practitioners specializing in school health, health promotion, and adolescent health—participated in interviews lasting 45 to 75 minutes. The discussions centered on essential concepts related to personal health knowledge, attitudes, and skills. Insights from both the interviews and the literature review informed the development of an initial 40-item pool, which was then organized into three domains: Knowledge (26 items), Attitude (11 items), and Skills (3 items).

Validity and Reliability - Content validity was assessed through expert evaluation using the Content Validity Index (CVI). The overall CVI was 0.85, exceeding the minimum acceptable criterion of 0.79.

Following the development of the initial questionnaire, a pilot test was conducted with 30 participants. Internal consistency reliability was calculated using Cronbach's alpha, which yielded a value of 0.74, indicating acceptable reliability for a newly developed instrument and providing a basis for further refinement.

In the main study sample, the internal consistency of each subscale was calculated separately. Cronbach's alpha coefficients were 0.88 for Knowledge, 0.74 for Attitude, and 0.90 for Skills, demonstrating good to excellent reliability.

The finalized questionnaire comprised 40 items, all scored on a 5-point Likert scale ranging from "Very Low" (1) to "Very High" (5). This scoring approach enabled both quantitative and qualitative assessment of participants' responses and enhanced the instrument's ability to discriminate among different levels of knowledge, attitude, and skill.

Data Collection

Initially, to develop the questionnaire items, a structured interview was conducted with 10 health education experts. Each interview was carried out in person and lasted between 45 and 75 minutes. After establishing content validity, the finalized questionnaire, consisting of 40 items, was administered in person both before and after completion of the educational program.

Data Analysis

After the training sessions concluded, all participating students were asked to complete the questionnaire again based on their updated perspectives. Statistical analysis was performed using SPSS version 22. The Shapiro–Wilk test was applied to check the data for normality. For each outcome measure (knowledge, attitude, and skill), pretest scores of the experimental and control groups were initially compared using independent samples t-tests to assess baseline equivalence.

If a statistically significant difference was found in the pretest scores ($P<0.05$), the difference between posttest and pretest scores (gain scores) was computed for each participant, and these gain scores were compared across groups using independent samples t-tests. Conversely, if no significant difference was detected in the pretest scores, posttest scores were compared directly between the groups using independent samples t-tests.

Besides between-group comparisons, changes within each group were examined by comparing pretest and posttest scores using paired samples t-tests. When data did not meet the normality assumption, nonparametric alternatives were used: the Wilcoxon signed-rank test for paired comparisons and the Mann–Whitney U test for independent group comparisons.

Ethics - The study received ethical approval from the Ethics Committee of Arak University, Arak, Iran. Participants were thoroughly informed about the goals and methods of the research, and their participation was entirely voluntary. Confidentiality and anonymity of all data were preserved throughout the entire study process.

Results

Of the 45 individuals initially recruited, 38 were ultimately enrolled in the study and randomly allocated to one of two groups: the intervention group (n=19), which received six interactive micro-video sessions on personal health education, or the control group (n=19), which received standard instruction. Figure 1 presents the details of participant recruitment.

Mean age and access to digital devices were compared using independent samples t-tests and chi-square tests. No significant differences were found between the experimental and control groups. The demographic characteristics of participants in both groups is presented in Table 2.

Table 3 presents a comparison of pretest scores between the groups. The experimental group demonstrated significantly higher knowledge scores than the control group (P<0.001), whereas no significant differences were observed in attitude (P=0.30) or skill

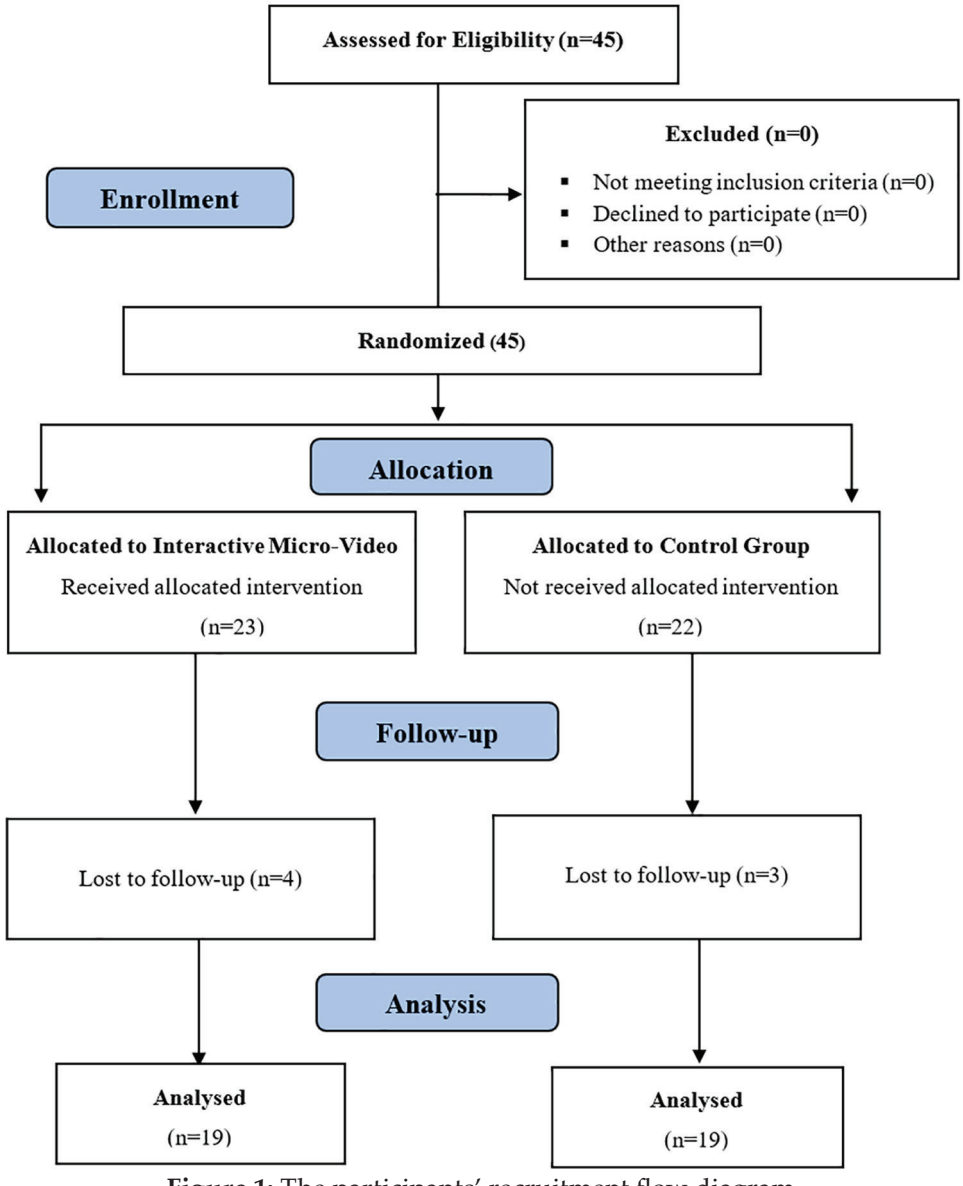

Figure 1: The participants' recruitment flow diagram

Table 2: Baseline demographic characteristics of experimental and control groups

Variable	Experimental group (n=19)	Control group (n=19)	P-value
Mean Age (years), Mean±SD	10.8±0.6	10.6±0.5	0.584
Access to digital devices (yes), n (%)	16 (84.2%)	16 (87%)	>0.999

Table 3: Comparison of pretest scores between experimental and control groups across three dimensions (Knowledge, Attitude, and Skill)

Dimension	Group	N	Mean±SD	P-value
Knowledge	Experimental	19	36.84±3.30	<0.001
	Control	19	30.26±3.84	
Attitude	Experimental	19	18.58±3.62	0.300
	Control	19	19.84±3.70	
Skill	Experimental	19	5.42±2 .09	0.980
	Control	19	5.32±1.89	

SD: Standard Deviation; N: Number of participants

Table 4: Post-test comparison of attitude and skill scores between experimental and control groups

Dimension	Group	N	Mean±SD	P-value
Attitudes	Experimental	19	22.00±3.97	0.234
	Control	19	20.47±3.80	
Skills	Experimental	19	9.47±2.93	<0.001
	Control	19	6.05±2.24	

SD: Standard Deviation; N: Number of participants

Table 5: Comparison of knowledge gain scores between experimental and control groups

	Group	N	Mean±SD	P-value
Post-test minus pre-test	Experimental	19	5.15±2.45	<0.001
	Control	19	0.89±1.48	

SD: Standard Deviation; N: Number of participants

(P=0.98).

Since no significant differences were found between the groups in pretest scores for skill and attitude, these variables were not statistically adjusted, and posttest comparisons were performed using independent samples t-tests or Mann–Whitney U tests as appropriate; the results are presented in Table 4.

Since there was a significant difference in pre-test knowledge scores between the groups, gain scores (calculated as post-test minus pre-test) were used for comparison. According to Table 5, the experimental group showed a significantly higher increase in knowledge (Mean=5.16, SD=2.46) than the control group (Mean=0.89, SD=1.49), with a p-value below 0.001. This finding indicates a strong positive effect of the video-based health education intervention.

Discussion

This study examined the effectiveness of interactive micro-video instruction in improving elementary students' health-related knowledge, attitudes, and personal health skills. The findings demonstrated that the intervention significantly improved knowledge and practical health skills, while changes in attitudes were positive but not statistically significant. These results underscore the potential of micro-video–based health education as an effective pedagogical approach, particularly for younger learners, and contribute to the growing literature advocating for the integration of digital tools into school-based health promotion (1, 2).

The substantial improvement in knowledge observed in the intervention group is consistent

with previous research demonstrating the positive impact of multimedia and animated health education tools on learning outcomes. Hayat (23) reported that video animation significantly improved elementary students' handwashing knowledge and skills, while Lekaram and colleagues (24) found that video-based edutainment enhanced oral health knowledge and attitudes. These findings reinforce the idea that multimedia content, especially when visually engaging and developmentally appropriate, supports deeper cognitive processing and better retention. The micro-videos used in the present study likely enhanced learning by providing concise, focused modules aligned with children's attention spans, thereby facilitating efficient cognitive integration.

The theoretical basis for these improvements can be understood through Mayer's Cognitive Theory of Multimedia Learning, which emphasizes that meaningful learning occurs when verbal and visual channels are integrated effectively (9, 14, 25). Principles such as coherence, signaling, and temporal contiguity help learners manage cognitive load and focus on essential information, avoiding extraneous material that can overwhelm working memory (22). The micro-video format used in this study closely aligns with these principles by presenting short, structured modules that reduce cognitive burden while emphasizing key concepts. Consequently, the design of the instructional materials—not merely the use of digital media—likely contributed to the significant gains in knowledge.

As Kraft notes (26), larger or more sustained interventions tend to yield more substantial attitudinal changes in educational settings. Additionally, the sample size of 38 students may have limited the statistical power to detect smaller attitudinal effects (27). In contrast to the strong cognitive outcomes, the attitudinal changes observed were modest and statistically not significant. This pattern aligns with scholarship highlighting the greater difficulty of shifting attitudes compared to knowledge or skills. Attitudes are shaped by personal experiences, cultural context, and social influences, making them more resistant to short-term interventions (28). Shah and Khan (18) also found that while multimedia-aided teaching improved attitudes, such improvements typically required active learning, teacher facilitation, and reinforcement—elements that may not have been fully present in the current intervention.

Despite limited change in attitudes, the significant improvement in students' practical health skills highlights the value of interactive micro-videos in promoting behavioral learning. The videos provided clear demonstrations and modeled appropriate health behaviors—an approach long supported by Bandura's Social Cognitive Theory, which emphasizes observational learning and self-efficacy as key components of behavior acquisition (29). Skills-based health education, as recommended by the World Health Organization, is particularly effective when it includes modeling, guided practice, and opportunities for repetition (17). The micro-video method supports these suggestions by enabling learners to repeatedly view demonstrations and fully grasp the procedural steps.

The ability of micro-videos to enhance skill development is also supported by research in medical and health professions education, where video-based instruction has consistently been shown to improve procedural competence and performance (30). Younger learners, who benefit from concrete and visual examples, may find video modeling especially helpful for mastering health-related behaviors such as proper hygiene, physical activity routines, or nutrition practices.

Beyond individual learning outcomes, the findings have important implications for school health programs. Traditional school health education often faces challenges such as inconsistent delivery, limited instructional time, inadequate teacher training, and disparities in resource availability (3, 6). Digital micro-video instruction offers a scalable, replicable, and cost-effective supplement that can help address these gaps.

As emphasized by Mann and Lohrmann (6), achieving equitable, large-scale delivery of effective school health education requires standardized tools that maintain quality across contexts—something digital content is well positioned to provide. Furthermore, the rise of remote and hybrid learning models, especially during crises such as the COVID-19 pandemic, has further underscored the need for flexible and accessible digital health education resources (7, 12, 31).

However, the integration of digital tools also raises important considerations related to equity and digital literacy. While most students in this study had adequate access to digital devices, broader disparities in digital access remain a concern, particularly in low-resource communities. Van Dijk (32) emphasizes that the digital divide encompasses more than hardware access, extending to differences in digital skills, learning support, and technological infrastructure. Greenhalgh and colleagues (33) similarly highlight barriers related to adoption, scale-up, and sustainability of digital technologies in educational and health settings. Therefore, future efforts to scale micro-video–based health education must ensure equitable access and provide adequate training for both teachers and students.

Recent studies further support the promise of interactive video and microlearning for youth health education. Yu and colleagues (34) found that interactive video lessons significantly improved adolescents' nutrition knowledge and healthy behaviors, while Bi and colleagues (35) reported that digital interventions enhanced physical activity and hygiene behaviors among schoolchildren. Microlearning, defined by short, targeted learning modules, has also been shown to improve engagement, retention, and learner motivation (36, 37). Given that younger learners often have shorter attention spans and prefer dynamic content, micro-videos appear to be especially well suited for delivering health education in primary school settings.

Overall, the results of this study demonstrate that interactive micro-video instruction can effectively enhance elementary students' health knowledge and practical skills. Although attitudinal changes were limited, this is not unexpected given the short duration of the intervention and the complexity of altering affective constructs. The findings highlight the importance of combining multimedia tools with longer-term engagement strategies, teacher facilitation, and social reinforcement to support comprehensive attitude development.

In conclusion, this study contributes meaningful evidence to support the integration of cognitively informed digital microlearning tools into school-based health education. By leveraging interactive, visually engaging, and developmentally appropriate media, educators can enhance the quality, accessibility, and sustainability of health promotion efforts in schools. As educational systems increasingly adopt digital resources, micro-video instruction stands out as a promising and scalable approach for fostering health-literate, informed, and empowered future generations.

Limitations and Suggestions

This study had several limitations that affect the interpretation and generalizability of its findings. The small sample size and focus on a single boys' school in Tehran restricted statistical power and external validity. The short six-session intervention period may have been insufficient for lasting attitudinal change, and reliance on self-reported questionnaires introduced potential response bias. Additionally, the absence of long-term follow-up prevented evaluation of knowledge and skill retention, and the study design did not compare the intervention with other active learning methods.

Future research should include larger, more diverse samples across multiple regions, extend the intervention duration, and incorporate longitudinal follow-ups to assess long-term effects. Using mixed-methods designs that combine self-reports with observational measures would yield more comprehensive insights. Exploring

combinations of interactive micro-videos with strategies such as gamification, peer learning, and teacher-led discussions is recommended. Finally, collaboration among educators, health experts, and media designers can support the integration of age-appropriate, evidence-based micro-video instruction into primary school health education curricula.

Conclusion

The present study demonstrated that interactive micro-video instruction is an effective and engaging educational approach for improving elementary students' health-related knowledge and practical skills. By applying cognitive multimedia learning principles, this method fosters deeper understanding and active participation compared to conventional instruction. Although the short-term intervention did not significantly influence students' attitudes, the findings underscore the pedagogical and practical potential of digital microlearning tools in school-based health education. As digital learning continues to expand, integrating interactive and evidence-based multimedia resources into the educational system can enhance the quality, accessibility, and sustainability of health promotion efforts. Overall, this study contributes to the growing body of evidence supporting innovative, technology-assisted health education as a cornerstone for developing informed, responsible, and health-literate future generations.

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AI-supported tools were utilized for improving language clarity and refining the writing. All aspects of the work—including conceptualization, study design, data analysis, interpretation of results, and preparation of the final manuscript—were independently completed by the authors.

Authors' Contribution

RM was responsible for conceptualizing the study and designing the research. He developed the instructional materials, supervised the entire research process, performed the statistical analysis, interpreted the findings, and handled the revisions of the manuscript. SA collected the data and implemented the intervention sessions. She also contributed to data analysis and interpreting the results. Both authors reviewed and approved the final version of the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of Arak University, Arak, Iran (approval code: IR.ARAKU.REC.1403.031), issued on May 29, 2024. All participants were informed about the purpose and procedures of the study, and their participation was entirely voluntary. Confidentiality and anonymity of participants' data were ensured throughout the research process.

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Availability of Data and Materials

All data supporting the findings of this study are included within the article. Additional datasets generated and analyzed during the study are available from the corresponding author upon reasonable request.

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