




## Integrating digital comics into physical education: a new model for enhancing elementary athletic learning

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### ABSTRACT

**Background:** By integrating interesting and interactive visualisations, digital comics are expected to help students to better understand the concept of athletic techniques and increase their interest in participating in lessons. This approach provides a solution to the challenges in learning basic athletics, which are often considered boring and difficult to understand by students. **Research Objective:** This research aims to develop digital comics as a learning tool in physical education to improve students' understanding and basic athletic skills. Through interactive visual media, it is hoped that students will be more motivated and better understand the concepts. **Method:** This research uses the ADDIE method, which includes the stages of analysis, design, development, implementation, and evaluation. The respondents of this study are class IV students at MI Plus Al-Fatimah Bojonegoro, totalling 42 students, consisting of 18 boys and 24 girls. The digital athletic comic was validated by 3 experts consisting of 1 media expert, 1 content expert, and 1 athletic practitioner. The results obtained were then analysed using the content validity index and content validity ratio. **Finding/Result:** The validation results by 3 experts that have been analysed show that the content validity index obtained an average score of 4.45, and the content validity ratio analysis showed an average score of 4.47. This shows that the digital comic model developed is very appropriate and relevant and meets the quality standards needed to increase student understanding and motivation in learning basic athletics. **Conclusion:** Digital comics have been shown to be effective as a learning tool to increase students' understanding, participation and motivation in basic athletics. For future research, it is recommended that the application of digital comics be extended to other subjects by involving larger groups. In addition, further research could examine the long-term impact of using digital comics on students' academic achievement and motor skills.

**Keywords:** Digital comics; physical education; athletic learning; teaching assistance; mbkm

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## INTRODUCTION

The Industrial Revolution 4.0 has opened up new opportunities in various sectors, including education (Yuhastina et al., 2020). In education, digital technology is no longer a novelty. Physical Education teachers have shown their adaptability to this change by utilising technology to support learning (Pozzi et al., 2021). This is in line with the need for innovation in facing the challenges of the digital era. One relevant innovation in education is the use of digital comics as learning media. This media combines interesting visuals and informative narratives to increase students' learning motivation

(Rusmitaningsih et al., 2024; Trisnawati et al., 2024). Especially in elementary school, digital comics help students understand complex material in a simple and fun way, thus supporting effective learning (Zulkifli et al., 2024; Perdima et al., 2023; Da'i et al., 2021). Digital comics can help students become more motivated and understand complex subject matter, especially in elementary school (Hasanah, 2021; Melliou et al., 2014; Sujinah et al., 2023). Technology in education is becoming increasingly important in today's technological era to adapt to the learning styles of the younger generation, who are more familiar with digital devices (Widiyono & Millati, 2021).

Digital comics are still rarely used, especially in athletic education, but many previous studies have shown that visual media like comics can aid the teaching and learning process (Bikalawan, 2024; Nugraha et al., 2017; Rehlinghaus, 2024; Yarmani et al., 2024; Golding & Verrier, 2020). Therefore, this research aims to develop digital comics as a learning medium for class IV students, which is expected to be a solution to the limitations of conventional learning media.

In line with the development of digital technology, the use of comics as learning media is not only relevant for general subjects, but also has great potential in Physical Education, especially in supporting the understanding of athletic movements and concepts. The utilisation of digital comics in Physical Education learning is an innovation (Minarni et al., 2019). Physical Education teachers adjust the content of comics to suit the learning objectives in the Merdeka Curriculum, so that learning objectives can be achieved. The use of comic media makes the learning process more interesting because comics not only contain text but also images that can attract children's interest (Matuk et al., 2021). Along with the development of technology, comics have transformed into a digital form that contains still images and text that create a story, providing a clearer and more vivid depiction, thus attracting students' attention and interest in learning (Chen, 2022; Hosseinzadeh et al., 2024; Xing & Qi, 2023; Zhou, 2020). This digital comic can be read on electronic devices such as mobile phones, laptops, and computers (Berube et al., 2024). The digital comic media developed in this research is thematically integrated, making it suitable for learning in elementary schools. Integrated themes mean combining several learning materials with different standards (Sari et al., 2018).

Considering the effectiveness of digital comics in increasing students' interest and understanding, it is important to explore how this media can be adapted for Physical Education learning, especially in supporting the mastery of motor skills and physical activity. Physical activity includes all body movements that require physical activity, such as walking, dancing, and honing motor skills (Nopiyanto & Raibowo, 2020). Physical Education learning that is planned and structured with repetitive movements that aim to improve physical fitness is known as sports (Firmansyah et al., 2022). Physical Education learning is important for maintaining the body's energy balance and preventing the accumulation of fat and obesity (Bachtiar & Bakti, 2018). Physical Education learning is an integral part of daily life that supports a person's health (Aliriad et al., 2023). However, some individuals have no desire or drive to participate in Physical Education learning, while others enjoy the activity (Næss et al., 2014; Invernizzi et al., 2019). Physical activity can be done with varying levels of intensity, ranging from light, moderate, to vigorous. Overall, any type of exercise that involves physical activity can improve fitness and strengthen the immune system, depending on the level of intensity and duration (Hardinata et al., 2024). In addition, physical activity must also be fun so that it does not get boring quickly and must contain elements of local wisdom, so that it not only improves fitness but also preserves local culture (Syahputra, 2016).

In addition to improving students' understanding of learning materials, digital comics can also accommodate the integration of education and preservation of local culture through a local wisdom-based approach. Research conducted by [Firdaus et al. \(2022\)](#) discusses the development of smartphone-based digital comic learning media for elementary school students to enhance their interest and learning outcomes. The research findings indicate that digital comics are effective in enhancing students' interest and understanding of learning materials. This study aims to design an Android-based mobile learning application that can increase students' interest and motivation in learning athletics. The research findings revealed that this application is effective in increasing students' interest and understanding of athletic materials, as well as getting positive responses from media experts and users.

This research aims to fill the gap in previous research by developing digital comics specifically designed to support basic athletic learning in Physical Education in elementary schools. Integrating athletic materials into the preservation of local wisdom is an educational strategy that combines physical exercise with cultural values that are rich in tradition. The basics of athletics such as running, jumping and throwing can be modified to reflect traditional games or competitions that have long existed in the community. Learning can be adapted to local values, so that it is not only a physical exercise but also a means of introducing local culture to students ([Nevitaningrum et al., 2023](#)). According to [Samodra & Gustian \(2021\)](#). This approach not only increases student participation in athletic learning but also arouses a sense of love for cultural heritage that is less known by the younger generation. Therefore, combining athletic material in Physical Education learning for grade IV elementary school students that focuses on local wisdom is the right step to introduce and maintain the sustainability of community culture ([Suyato et al., 2024](#)).

The utilisation of digital comics as a learning medium for Physical Education has received increasing attention in modern education. This media is considered to be able to increase student involvement, facilitate understanding of motion concepts, and provide a fun learning experience. Research by [Suprpto et al. \(2024\)](#) The present study demonstrates that digital comic media can effectively enhance learning motivation and the ability to understand complex material, especially in the context of Physical Education, which requires movement visualization. Furthermore, digital comics enable more flexible content presentation and can be accessed through electronic devices, rendering them a relevant medium in the digital era ([Sargent & Calderón, 2021](#)). This research is important because it answers the need for innovative learning media that suits student preferences in the digital era, helping to increase student motivation and understanding in athletic learning which is often considered difficult to understand theoretically.

## **METHOD**

This research uses a development method with the ADDIE approach, which consists of five stages: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation ([Pribadi, 2016](#)). The primary objective of the present analysis is to identify the needs and issues in athletic learning in elementary schools, with a particular focus on the challenges in improving students' understanding. This analysis involves the gathering of information through literature studies and interviews to understand the characteristics of students and the appropriate learning media needs. The second subsequent phase is design, which involves the creation of a digital comic. This process entails the determination of the structure of the content, visuals, and scenarios that used to facilitate students' comprehension of the fundamental concepts of athletics. At this stage, preliminary

sketches and storyboards are created as visual guides before the development process. The third subsequent phase is that of development, in which the digital comic media is created based on the designs that have been made. This stage involves the use of specialised software for the production of digital comics, with multiple revisions undertaken based on expert feedback. Validation by experts is also conducted to ensure that the content and media align with the learning objectives. The fourth stage is that of implementation, in which the digital comic is tested on a small group of students to ascertain its initial effectiveness and to receive student feedback. Subsequently, field trials were conducted with older students to measure the impact of comics on understanding and learning motivation. The final stage is evaluation, which involves the analysis of data obtained from the implementation stage to assess the success and effectiveness of the digital comic media. At this stage, a comprehensive evaluation is conducted to identify the strengths, weaknesses, and potential improvements so that digital comics can be optimally applied in basic athletic learning.

### Digital Athletic Comics

Digital Athletic Comics represents an innovative interactive learning medium that assists students in comprehending fundamental athletic movements, including running, jumping, and throwing. Utilising characters, narratives, and visually appealing illustrations, this comic medium has been found to enhance the enjoyment and efficacy of the learning process. Teachers can utilise this medium in the classroom through projection or on students' personal devices, either as an introduction before physical practice or as a reinforcement of understanding. This comic includes character figures, movement illustrations, narration and dialogue that explain techniques, step-by-step instructions, and self-practice. With this approach, students learn more actively and understand athletic techniques better.

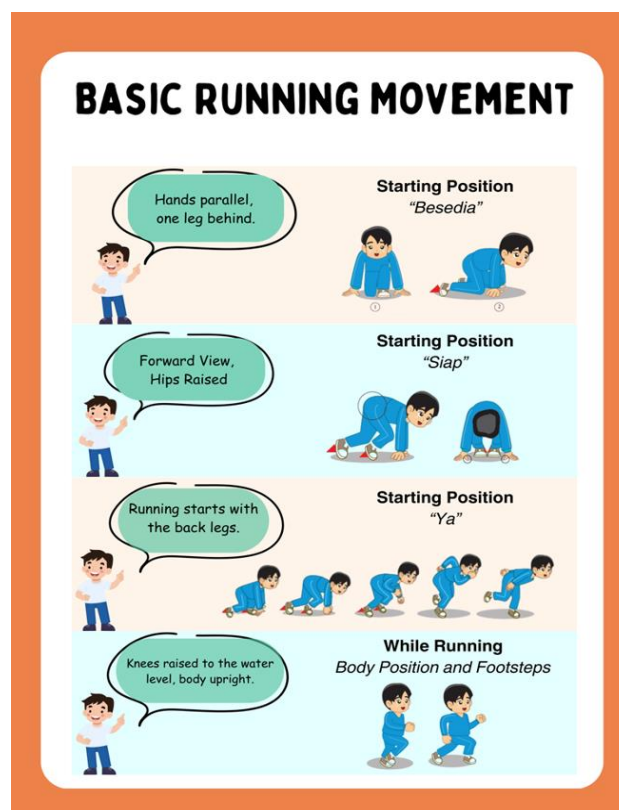


Figure 1. Digital Athletic Comics

**Table 1. Student Assessment Questionnaire**

No.	Question	Answer
1	Does digital comics help you understand the basic techniques of athletics?	Yes / No
2	Are the illustrations in the digital comic easy to understand?	Yes / No
3	How engaging do you find using digital comics in athletic learning?	Yes / No
4	Do you feel more motivated to practice athletic movements after reading the comic?	Yes / No
5	Does digital comics make it easier for you to remember the steps of athletic movements?	Yes / No
6	Does the use of digital comics make athletic learning more enjoyable?	Yes / No
7	Do you feel that digital comics help improve your physical skills?	Yes / No
8	Does the digital comic provide a clear explanation of the athletic techniques being taught?	Yes / No
9	Do you want to use digital comics in other learning?	Yes / No
10	Does digital comics influence your understanding of basic athletics?	Yes / No
<b>Total Score</b>		

After the students fill out the questionnaire, the score for each answer is calculated based on the value **Yes** = 1 and **No** = 0. Then, the average score for each student is calculated by summing the scores obtained from each question using the following formula:

$$\text{Average Score} = \frac{\text{Total Score Count}}{\text{Number of Students}}$$

### Data Collection

The respondents of the respondents of this study comprised fourth-grade students of MI Plus Al-Fatimah Bojonegoro (academic year 2024-2025), with a total of 42 students, including 18 male and 24 female students. The determination of inclusion and exclusion criteria in this study was undertaken with the objective of ensuring that the subjects selected are aligned with the research objectives. The inclusion criteria encompass fourth-grade students of MI Plus Al-Fatimah Bojonegoro who are actively engaged in learning activities and possess the physical and mental faculties necessary to fully participate in the research. To ensure that the material in digital comics is appropriate, this research uses content validation. The product validation test was carried out by three experts consisting of one sports lecturer and two practicing teachers (Branch, 2019). Data collection in this study was carried out through validation tests by three experts, namely 1 media expert, 1 content expert, and 1 athletic sports practitioner. The media expert test is a tool used to evaluate the design, appearance, and readability of digital comics. The content expert test ensures that the content aligns with the fundamental principles of the athletic curriculum. The third test, administered by an athletic sports practitioner, evaluates the technical accuracy of the digital comics in relation to field practice. The results of this test are used to improve and refine digital comics to ensure their effectiveness and alignment with the basic standards of athletic learning.

After the measurement instrument was compiled, the Content Validity Index (CVI) and Content Validity Ratio (CVR) tests were conducted to assess the content validity of the instrument. CVI measures the extent to which the items in the instrument are relevant to the purpose of measurement, using Item-Level CVI (I-CVI), which is calculated based on the percentage of experts who agree on the item as relevant, with a minimum value of 0.78 to be considered valid, and Scale-Level CVI (S-CVI), which is the average of I-CVI, with an ideal value above 0.90. Meanwhile, CVR measures the importance of each item by

having experts' rate whether the item is essential, with scores calculated based on the number of experts who agree the item is essential. These two tests ensure the instrument has strong validity and appropriate relevance according to the purpose of measurement. The data collected in this research is both qualitative and quantitative. The expert validation components are presented in Table 2:

**Table 2. Expert Assessment Indicator**

Components	Indicators	Description
Accuracy of Material	The alignment of content with the curriculum, the accuracy of information, and the completeness of the material.	The material must comply with curriculum standards and not contain conceptual or factual errors.
Visual Design	Readability, color suitability, clarity of images or illustrations.	Visual design must support material comprehension, be engaging, and be appropriate for the age or level of the students.
Interactivity	Student engagement, the use of interactive elements, and ease of navigation.	Interactive teaching materials encourage active student participation and enhance learning motivation.
Language Comprehensibility	Clarity and appropriateness of language, ease of understanding, and fluency of narration.	The language used must be easily understood by students according to their level.
Learning Effectiveness	Achievement of learning objectives, improvement in understanding, and interest in learning.	Learning media is expected to help students achieve their learning goals in an enjoyable way.

Suggestions and feedback from experts form the basis of the basis of the revision. The validation and testing phases of the product implementation provide quantitative data (Zhang et al., 2024). Qualitative data in the form of written suggestions and input from experts conveyed through a questionnaire (Rayanto, 2020).

The data processing techniques employed utilised descriptive analysis techniques, which encompass the description of data through frequency, percentage, and average, thereby providing an overview of product acceptance or effectiveness based on measurement results. In addition, in order to ensure the quality of the instrument used, a validity test was conducted using the Aiken Index for expert judgement and a reliability test with the Cronbach's Alpha coefficient to measure the consistency of the instrument. Common qualitative analysis techniques include thematic analysis and content analysis. Furthermore, product feasibility testing was conducted to assess the extent to which the developed product could be used by evaluating it through the perspectives of experts and users. Feedback from users or respondents was analysed using Likert scales and open-ended feedback, which provided insight into the quality of the product and helped to improve it. The amalgamation of these data processing techniques thus enabled the researcher to comprehensively evaluate the effectiveness, feasibility, and quality of the developed product. Descriptive quantitative analysis of the data was performed using a Likert scale (interval 1-4), as shown in the following table:

**Table 3. Rating Scores the Scale.**

Score	Criteria
4	Strongly Agree
3	Agree
2	Disagree
1	Strongly Disagree

To determine product eligibility, the classification of the rank scale uses the rating scale (Zhang et al., 2023). The classification can be seen in the following table:

**Table 4. Classification of Rating Scales**

Score	Criteria
0 - 20%	Very not worth using
20.1% - 40%	Not worth wearing
40.1% - 60%	Worth using with repair
60.1% - 80%	Worth to use
80.1% - 100%	Very worth of use

## RESULTS AND DISCUSSION

The results and discussion of this research outlined the findings obtained through the tests and analyses that have been conducted. The findings have been validated by media experts, subject matter experts, and athletic sports practitioners, as well as trials on students as users of digital comics in basic athletic learning. The ensuing discourse will focus on the interpretation of the obtained results and their implications for the development of learning media, as well as their impact on enhancing students' comprehension and athletic aptitude.

### Expert Validation

The results of the validation test analysis, conducted using the Content Validation Index (CVI) and Content Validation Ratio (CVR), indicate the assessment of the quality and relevance of digital comics as a medium for basic athletic learning. This analysis was carried out by experts in the field. Complete data regarding the results of this validation test can be seen in Table 5 below:

**Table 5. Expert Validation**

Validation Type	Expert 1	Expert 2	Expert 3	Average	Criteria
Content Validity Index (CVI)	4.05	4.04	4.04	4.45	Highly Valid
Content Validity Ratio (CVR)	4.05	4.05	4.04	4.47	Valid

The high Content Validity Index (CVI) and Content Validity Ratio (CVR) scores indicate that the digital comics are very relevant and in accordance with athletic learning objectives. The CVI score of 4.45 indicates that the majority of experts considered the items in the digital comic to have a strong relevance to the material being taught, in accordance with curriculum criteria and basic athletic learning objectives. In other words, this digital comic includes elements that are considered important and essential in learning. The CVR score of 4.47 indicates that the experts agreed that this comic is not only relevant in content but also in accordance with the contextual needs of students in understanding athletic techniques. This high validity contributes to the effectiveness of the learning tool, as the material presented has been tested for relevance, ensuring that students obtain appropriate and useful information in improving their athletic skills.

### Field Trial Result

The results of the field trials were obtained from research respondents consisting of 42 fourth-grade students from MI Plus Al-Fatimah Bojonegoro, comprising 18 male students and 24 female students, as shown in Table 6 below:

**Table 6. Field Trial Result (N=42)**

Score	Frequency	Category
9 - 10	12	Very Good
7 - 8	15	Good

5 - 6	3	Poor
3 - 4	0	Less
1 - 2	0	Very Less

Content Validity Index (CVI) and Content Validity Ratio (CVR) scores were obtained through expert assessment using a questionnaire that measured the relevance of digital comic elements to learning objectives. Each expert rated the items using a scale from 1 (very poor) to 5 (very good). The CVI score is calculated based on the percentage of experts who gave each item a high rating, while the CVR measures the expert consensus regarding the relevance of the item. This process ensures a measurable and transparent evaluation, which illustrates the extent to which digital comics are valid for use in athletic learning.

The resulting product is a digital comic for physical education learning with a theme of athletic education based on local wisdom. Learning media is adjusted according to the steps of the ADDIE development model. The first stage in the ADDIE model is the analysis stage, which aims to ensure that the digital comic product based on local wisdom meets expectations. To support the product results, a literature review was conducted using articles from the last 10 years to obtain novelty. In addition, the sources of the literature review also come from the field of athletics and traditional games managed by the Indonesian Committee for Traditional and Folk Games (Azahari, 2017). Observations in the field indicate that students have not yet utilised digital teaching materials in physical education learning. The second stage is the product design stage. At this stage, based on the results of previous research on the topic of analysing basic movement activities in athletics based on local wisdom to enhance athletic movement skills, data has been obtained regarding various basic athletic movement activities rooted in local wisdom (Faradila et al., 2024). This data is used as material to design the first prototype.

The third stage is the development stage. At this stage, input is needed from sports lecturers who have expertise in sports and athletics, traditional games, including history, philosophy, equipment, and types of sports or traditional games. Additionally, feedback is also obtained from physical education teachers regarding the stages of learning athletics and traditional games, tailored to the motor skills and appropriate physical activity levels for class IV students. Stage four is the implementation stage of digital comic learning media for physical education with a local wisdom-based athletics theme, aimed at evaluating the effectiveness of the product in the learning process for fourth-grade students at MI Plus. Al-Fatimah Bojonegoro.

The fifth stage is the evaluation stage, in which formative evaluation is conducted to assess the product based on the results of feasibility/validation tests from experts and class IV students at MI Plus Al-Fatimah Bojonegoro. To make the learning process more engaging, teachers use various tools from the current media developments (Baert, 2015; Kim & Kwak, 2022; Rapanta et al., 2021; Bygstad, 2022; Varga & Révész, 2023; Haleem et al., 2022). One of the digital comics that serves as an interesting and effective learning medium. Students are usually more interested in images presented than in reading materials during the learning process. With digital comics, students have a greater curiosity, making the learning material presented in comic form easier to understand (Harianto et al., 2023). With the advancement of technology, the use of digital comics as a learning medium aligns with the needs of the education sector (Wibowo, Sukarmin et al., 2023). Based on the explanation above, the digital comic for athletic learning based on local wisdom is an educational innovation that promotes economic digitalisation and serves as an effective teaching material in digital form, making it easier for students to learn anytime and anywhere.

This research project has produced a thematic digital comic on Physical Education that focuses on basic athletic movements based on local wisdom for class IV elementary school students. The digital comic has been designed to function as both a learning medium and a Physical Education learning model, with the objective of integrating local wisdom through the medium of athletic sports (Jakubík & Brod'áni 2023; Samodra et al., 2022; Da'i, 2021). The purpose of developing this digital comic is to achieve four main competencies: 1) spiritual attitude competency, 2) social attitude competency, 3) knowledge competency, and 4) skill competency. This digital comic is expected to serve as an innovative and engaging learning medium for class IV students in Physical Education, in a way that is relevant to the local culture and traditions of the community.

The formulation of spiritual attitude competence is "Appreciating and embodying the teachings of the religion they adhere to" (Sueca et al., 2024). The assessment of social attitude competency is "Demonstrating honest behaviour, discipline, responsibility, politeness, care, and confidence in interactions with family, friends, and teachers" (Claver et al., 2020; Marheni et al., 2021; Cilla et al., 2023). The competency can be achieved through indirect learning, which involves exemplary habits and a positive school culture, while taking into account the characteristics, needs, and conditions of the students.

It is hypothesised that the utilisation of digital comic research exerts a favourable influence on the domain of class IV athletic learning, both in a general sense and with regard to specific applications. The potential general impact may be characterised by an increase in student interest and motivation to learn, attributable to the utilisation of contemporary digital learning media. The utilisation of digital comics has the potential to enhance the learning process by making it more interactive and engaging, thereby fostering greater enthusiasm and involvement among students. The specific impact is predicted to be an enhancement in students' comprehension of fundamental athletics concepts, attributable to the capacity of digital comics to elucidate techniques and theories in a manner that is uncomplicated and readily comprehensible. Additionally, digital comic-based learning has the potential to indirectly contribute to the development of student motor skills by providing a visual and conceptual connection to athletic material.

In terms of knowledge competence, students are expected to understand the basic concepts of athletic sports such as running, jumping, and throwing, and master the technical principles of each of these branches. Students are also expected to understand the benefits of physical activity for health and master the basic rules of athletic sports that apply. With interesting visuals presented in digital comics, students more easily recognise and understand the correct movements and body positions in various athletic activities. While from the aspect of skill competence, students are expected to be able to practise basic athletic movements according to the correct techniques, such as starting techniques in running, jumping with good balance, and throwing with the correct technique. In addition to improving gross and fine motor skills, students are also expected to be able to follow athletic instructions better because they have understood the sequence and details of the movements described visually in digital comics. This competency helps students achieve conceptual understanding and practical skills in athletics comprehensively (Marheni et al., 2024; Nugraha et al., 2022).

Recommendations for readers and other researchers who are interested in conducting similar research on digital comics in grade IV athletic learning are to consider several aspects that can expand the scope and impact of this research. First, it is recommended that further research include topics and teaching materials in various sports so that students can understand various athletic concepts through more diverse digital comic media. In addition, conducting trials in different populations or levels of education can

also be a strategic step to see the effectiveness of digital comics in varied environments in order to expand the generalisation of research results.

Improving comic design is also an important recommendation, especially considering the development of digital technology. The addition of multimedia features such as animations or simple sounds can make digital comics more interactive and attractive to students. To provide more comprehensive results, future research should also examine the long-term effects of using digital comics on improving students' athletic ability and motor skills. This helps deepen the understanding of the impact of comic media in physical education. To increase interactivity in digital comics, the addition of animation and sound elements can be a very effective step. Animation can help visualise movements or processes that are difficult to understand with just static images, while sound can add depth to the learning experience, such as narration or sound effects to bring situations to life. In athletic learning, animations showing basic movement steps or sounds describing correct techniques can clarify the material. For reference, some educational applications such as [Jastrow et al. \(2022\)](#) have successfully implemented animation and sound to increase user engagement. Research by [Wijaya et al. \(2024\)](#) also shows that interactive media, including animation and sound, increase students' understanding and interest in digital comic-based learning.

## CONCLUSION

The findings of this study demonstrate that the utilisation of digital comics as a medium for the instruction of physical education engenders a favourable impact on the level of interest and comprehension of fundamental athletic principles among elementary school students. Digital comics have been found to facilitate attractive visualisation of athletic movements, thereby enabling students to more readily understand basic concepts and techniques through interactive means. This increased active participation, in turn, strengthens students' motor skills and supports their comprehensive understanding of the material. However, the study is not without its limitations, which are related to the uneven access to technology in some schools, as well as the need for further training for teachers to optimally integrate digital comics in learning. In order to evaluate the effectiveness of digital comics in a broader range of conditions, it is recommended that future research involve schools with more diverse backgrounds. Furthermore, the development of digital comics with additional interactive elements, such as motion animation and exercise simulations, has the potential to further enrich students' learning experience. Teachers should be trained in the integration of digital comics into the physical education curriculum, with the potential to enhance teaching quality and student competence in understanding basic athletic skills.

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## CONFLICT OF INTEREST

There is no conflict of interest in this study.

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