JPPS (Jurnal Penelitian Pendidikan Sains)
Homepage : https://journal.unesa.ac.id/index.php/jpps
Email : jpps@unesa.ac.id

p-ISSN : 2089-1776 **; e-ISSN :** 2549-1597
JPPS, Vol. 14, No. 2, May 2025 : 96-107

(Jurnal Penelitian Pendidikan Sains)

Development of Contextual-Based E-Comic Learning Media to Improve Students' Critical Thinking Skills in Plantation Areas

Iwan Wicaksono[1*], Muhammad Husni Farros[1], Sallimah Binti Hj Mohd Salleh[2], Yong Chin Chen[3], Ulin Nuha[1]

[1]University of Jember, Jember, Indonesia
[2]University of Brunei Darussalam, Bandar Seri Begawan, Brunei Darussalam
[3]SM Pengiran Isteri Hajjah Mariam, Bandar Seri Begawan, Brunei Darussalam

DOI : *https://doi.org/10.26740/jpps.v14n2.p80-107*

Sections Info

Article history:
Submitted: March 21, 2025
Final Revised: May 17, 2025
Accepted: May 21, 2025
Published: May 28, 2025

Keywords:
Contextual
Critical Thinking
E-Comic
Plantation Area

ABSTRACT

Objective: *Critical thinking skills are a crucial component of education. However, in the context of education in Indonesia, the development of critical thinking skills has not yet reached the expected level. The low level of students' critical thinking skills is due to the limited use of innovative learning media in science education at school. One potential solution is the use of contextual-based e-comics. This study aims to evaluate the validity, practicality, and effectiveness of contextual-based e-comic products.* ***Method:*** *The research employed a Research and Development (R&D) approach using the ADDIE model.* ***Results:*** *The validity of the contextual-based e-comics received an average score of 90%, placing it in the very valid category. The practicality score averaged 89%, categorized as very practical. The effectiveness measured by an average N-Gain of 0.70, falls into the high category with a student response rate of 95% and classified as very good.* ***Novelty:*** *This study introduces an innovation in learning media by developing e-comics that integrate a contextual approach to improve junior high school students' critical thinking skills in plantation areas. The selection of plantation areas adds a novel aspect and differentiates this study from previous studies, aiming specifically to improve critical thinking skills of junior high school students in plantation areas.*

INTRODUCTION

Science learning has highly complex characteristics that require critical thinking to analyze problems. According to Putri et al. (2021), scientific thinking is closely related to the process of discovering and understanding the universe in an organized manner, which contains concepts, theories, or formulas that must be deeply understood. Higher order thinking skills are recognized as a useful ability in education and act as an effort to foster national development in order to achieve the goals of the education system. One of the high-order thinking skills necessary for developing 21st-century competencies is critical thinking. Critical thinking is defined as an individual cognitive process aimed at making rational decisions about matters that can be reasonably considered correct (Jamaluddin et al., 2020).

Critical thinking skills are an important element in education. However, their development in Indonesia has not yet reached the expected level. The critical thinking ability of junior high school students remains low. This is supported by findings from Nurita et al. (2023) which stated that students who engaged in science learning based on local wisdom demonstrated low level of critical thinking, with an overall percentage of 51%. Current educators tend to focus on knowledge transfer, offering limited opportunities for students to develop critical thinking skills (Rahardhian, 2022).

Students can improve their critical thinking skills more effectively when the material taught is relevant to their daily lives and contextualized within their real-world experiences. One suitable approach is the contextual approach, as it can motivate students to understand the meaning of the subject matter and relate it to the existing problems (Hendaryono, 2023). The application of scientific knowledge must be done wisely to avoid negative impacts on the environment. Therefore, science learning materials should be contextually based and aligned with students' everyday lives (Aprilia, 2021). Plantation areas also offer potential as contextual learning resources, particularly for students who live or attend school in such regions, as they are typically more familiar with natural resources and agricultural practices. Teachers should utilize science learning media that are developed in accordance with the social, cultural, geographical, and familial backgrounds of their students. The surrounding environment can support the achievement of learning objectives and help students construct knowledge through direct experience (Herowati & Azizah, 2020).

Research conducted by Nuha et al. (2021) shows that students' low critical thinking skills are caused by the lack of innovation in the learning media used and the dominance of teachers in the science learning process at school. This situation results in students being less trained in developing their critical thinking abilities. This view is supported by observations at SMP Negeri 13 Jember where seventh-grade students demonstrate relatively low critical thinking skills in science learning. Students who consider science as a difficult subject are less active during lessons and there is no innovative learning media available to improve students' critical thinking skills. Based on field findings, the use of learning media in the learning process can facilitate students' understanding of the content being taught (Mukarromah & Andriana, 2022).

The learning media that can be utilized is electronic comics (e-comics). Electronic comics are educational tools that are easy to understand, with simple illustrations accompanied by commonly used everyday language making them accessible to a wide range of learners. The use of e-comics in the learning process can help students to develop their critical thinking skills. In addition, e-comics are expected to be used as a learning tool both inside and outside the classroom (Nafisa et al., 2023). This is supported by Laksmi and Suniasih (2021) which demonstrated that the development of PBL-based e-comic learning media received highly positive evaluations from experts and in trials. However, this study had a limitation as the trials were conducted on a small scale and the product was not tested for effectiveness. Therefore, further research is needed to address the effectiveness of e-comic learning media.

The novelty of this study lies in the product to be developed. Contextual-based e-comics designed to be relevant to students' real-life experiences, particularly within the context of plantation areas. Therefore, the purpose of this research is to examine the development of contextual-based e-comics in order to determine their validity, practicality, and effectiveness in science learning for junior high school students in plantation areas.

RESEARCH METHOD

Research Design

The method applied in this study is the research and development (R&D) approach using the ADDIE model.

The development of e-comic learning media that applies the ADDIE model is carried out through 5 steps including analysis, design, development, implementation and evaluation. Analysis is the initial stage in developing the e-comic learning media products. The initial steps at the analysis stage includes a needs analysis, curriculum analysis and classification of living things material to be adapted to the e-comics developed. The second stage is design which is carried out to develop products, research instruments, and learning tools based on the initial stage. The third stage is development stage which includes product validation conducted by three experts, two lecturer and one teacher, who asses the content, language, presentation and graphics aspect of the e-comic. The fourth stage is product testing which includes product testing after validation. This includes measuring practicality through observation sheets completed by three observers. Additionally, a pre-test is administered at the beginning of the lesson and a post-test at the end. A student response questionnaire is also distributed to gather feedback on the product. The last stage is the evaluation of e-comic learning media after being implemented in learning. This stage is carried out to measure the effectiveness of e-comic learning media to improve students' critical thinking skills. The results of the pre-test and post-test will be analyzed using the N-Gain formula and the student response questionnaire to the product.

Research Sample

This research was conducted at SMP Negeri 13 Jember to test contextual-based e-comics. The implementation was carried out in January during the even semester of the 2025/2026 academic year and was carried out at the VII B grade students. The research sample consisted of 30 students selected based on predetermined criteria using a Purposive Sampling technique.

Data Collection

This research data includes primary data and secondary data collected through the data collection process. The primary data included validity scores, practicality scores, and effectiveness scores. Validity scores were obtained using a questionnaire technique with an expert validation sheet as the instrument. Practicality scores were also collected using a questionnaire technique with an expert validation sheet for the e-comics. Effectiveness scores were collected using tests and questionnaire techniques with critical thinking skills test instruments and student response questionnaires. The secondary data of this study consisted of written sources or literature studies from books and journals, and internet sources.

Data Analysis

The data analysis process includes validity, practicality, and effectiveness tests, which involve N-Gain analysis and student response questionnaires. The percentage of questionnaire scores obtained from expert validation will be categorized based on the validity criteria presented in Table 1.

Table 1. Validity criteria

Score (%)	Category
81.25 % < score ≤ 100 %	Very valid
62.50 % < score ≤ 81.25 %	Valid
43.75 % > score ≤ 62.50 %	Fairly Valid
25 % ≤ score ≤ 43.75 %	Invalid

Nadzif et al. (2022)

The percentage score of the e-comics implementation observation sheet will be categorized based on the percentage of practicality level in Table 2.

Table 2. Practicality criteria

Practicality Percentage	Criteria
82% to 100%	Very practical
63% to 81%	Practical
44% to 62%	Practical enough
25% to 43%	Less practical

Sejati et al. (2021)

Data analysis conducted to measure the improvement of critical thinking skills will be categorized based on the N-gain scale according to Hake (1998) which can be seen in Table 3.

Table 3. N-Gain Criteria

N-gain value	Category
$g \geq 0.70$	High
$0.30 \leq g < 0.70$	Medium
$g < 0.30$	Low

Sutarto et al. (2021)

Data analysis conducted to determine student responses to e-comic learning media will be categorized based on the criteria for the percentage score of student response criteria which can be seen in Table 4.

Table 4. Student response criteria

Response (%)	Criteria
$81.25 < x \leq 100$	Very good
$62.25 < x \leq 81.25$	Good
$43.75 \leq x \leq 62.25$	Not good

Arianti et al. (2020)

RESULTS AND DISCUSSION

Results

Analysis

The initial stage in the development of e-comic learning media is a needs analysis, which aims to determine whether the product is necessary and aligns with students' needs. Based on the real conditions at school, students' critical thinking skills remain relatively low, as they perceive science as complex and are less active in the learning process. In addition, neither teachers nor students have previously implemented or utilized contextual-based e-comic learning media to enhance students' critical thinking skills in

science education. Science learning at this school refers to the Merdeka Curriculum, so the development of e-comics is adjusted to the demands of the curriculum.

Design

The development process focused on creating contextual-based e-comic learning media on the topic of classifying living things. The e-comic product development process includes several main stages, including: material preparation, storyline development, sketching, inking, coloring, and the addition of conversation balloons. The material was developed in accordance with the Merdeka Curriculum and contextualized to the classification of living things. The storyline stage involved is the process of compiling a storyline or narrative in text form. The storyline created will be in the form of a basic framework that describes how the story develops from beginning to end. This narrative was then visualized through sketching, which entailed creating rough drawings to determine panel layouts and image illustrations. The sketching process was carried out using the Medibang Paint and Clip Studio Paint applications. The sketches were then refined during the inking stage, where a stylus pen was used to trace and enhance the outlines, making the illustrations more visually appealing.

Figure 1. Sketching and inking stage

The next stage is coloring or coloring in the image section including characters, backgrounds, and illustrations in e-comics. The last stage is the provision of text using conversation balloons. These conversation balloons are designed to support interaction within the e-comic and are written in accordance with the *KBBI* (Kamus Besar Bahasa Indonesia) language standards, ensuring that the content is clear and easily understood by students.

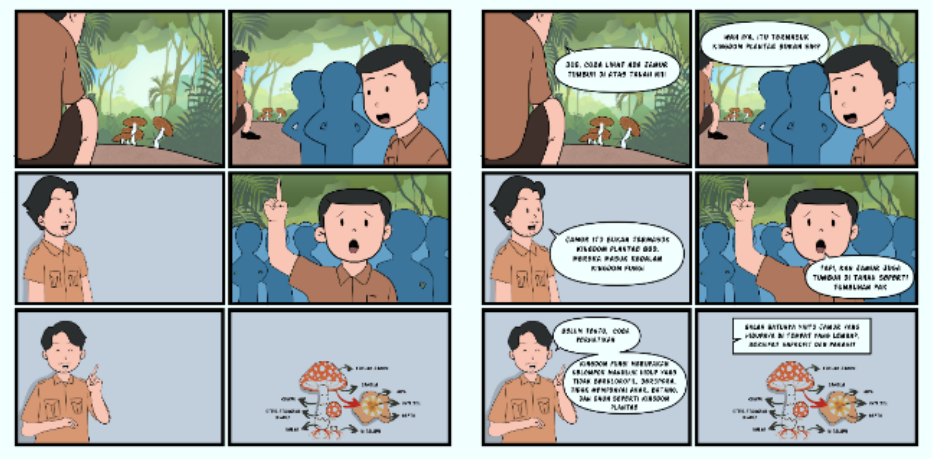

Figure 2. Coloring stage and conversation balloons

Development

The purpose of the research is to determine the validity, practicality, and effectiveness of e-comic learning media in improving critical thinking skills of junior high school students in plantation area. The development phase of the contextual-based e-comic learning media will be evaluated by media experts, which focusing on aspects such as content, language, presentation and graphics. This validation process aims to assess the validity and feasibility of the e-comic products before it is tested on students. The results of the expert validation of contextual-based e-comic products by media experts are presented in Table 5.

Table 5. E-comic validation results

No.	Criteria Aspect	Score Interval (%)			Average percentage of each aspect	Category
		Validator 1	Validator 2	Validator 3		
1	Content	92%	100%	92%	94%	Very Valid
2	Linguistics	83%	92%	83%	86%	Very Valid
3	Presentation	88%	94%	94%	92%	Very Valid
4	Graphics	92%	92%	83%	89%	Very Valid
Average		89%	94%	88%	90%	Very Valid

The results of the validation of contextual-based e-comic learning media by the three validators in Table 5 indicate a total average percentage of 90% across all aspect, which is categorized as very valid. Therefore, based on the validity criteria, the media meets the criteria for being considered very valid. This is in line with Oktaviana & Ramadhani (2023) who stated that digital comic-based science learning media can be declared very valid if it receives a score between 81-100%.

Implementation

Learning media that has been validated and declared valid or feasible then proceeds to the product trial stage. The implementation of the product is assessed by three observers using an implementation observation sheet to determine the practicality of the e-comic learning media. The aspects evaluated by the observers include link sharing, operation, studying, and completion of the activities provided in the e-comic learning media by students. The results of the practicality assessment of using e-comic media are presented in Table 6.

Table 6. Results of the implementation of the use of E-Comics

Aspects	Meeting (%)			Percentage	Criteria
	1	2	3		
Link sharing	100%	100%	100%	100%	Very Practical
Operate	92%	100%	92%	94%	Very Practical
Study	83%	92%	83%	86%	Very Practical
Working on	75%	75%	75%	75%	Practical
Average	88%	92%	88%	89%	Very Practical

Based on the results of the practicality data analysis in Table 6, it was found that the average score for the implementation of the contextual-based e-comics media was 89% and included in the very practical criteria. This proves that the developed contextual-

based e-comic learning media is highly practical for use in teaching Grade VII material on the classification of living things.

Evaluation

The effectiveness of the product measured through the results of the pre-test and post-test questions. The data obtained from the pretest and post-test were used as a benchmark for assessing the improvement students' critical thinking skills after using the contextual-based e-comics. The test results are analyzed using the N-gain formula and presented in Table 7.

Table 7. Pretest-posttest results

Data	Class VII B	
	Pre-test	***Post-test***
Number of students	30	
Lowest score	17	67
Highest score	50	96
Average	34	80
N-gain	0.70	
Category	High	

The critical thinking skills test consisted of six questions, each question contained one indicator of critical thinking skills. Based on Table 7, the N-gain obtained from the average pre-test and post-test scores of 30 students is 0.70. This result indicates that the increase in student learning outcomes is in the high category. It suggests that the use of contextual-based e-comics is effective in enhancing the critical thinking skills of Class VII B students in science learning, particularly in the topic of classification of living things. The effectiveness of the contextual-based e-comic product was also measured through student response questionnaires administered after using the e-comic. The analysis of the questionnaire results is presented in Table 8.

Table 8. Student response questionnaire results

No.	Aspects	Percentage	Criteria
1	Display and Design	94%	Very good
2	Contents	93%	Very good
3	Linguistics	98%	Very good
4	Benefits	93%	Very good
Average student response		95%	Very good

Student response questionnaires were distributed after completing the post-test. Based on the results presented in Table 8, student responses to the use of e-comic learning media reached 95%, which considered into the excellent category. These findings are supported by research conducted by Arianti et al. (2020), which states that student responses are considered effective if more than 75% of students give a positive response.

Discussion

The results of the e-comic media validation analysis in Table 5 indicate that the product is valid based on the obtained assessments. All aspects of the developed e-comic product

including content, appearance and design, language, and graphics are considered very valid with an overall average percentage of 90%. This shows that the contextual-based e-comics is valid and feasible for improving students' critical thinking skills. These results are in line with previous research which stated that contextual-based comic media are highly feasible and effective in the learning process (Yudea et al., 2024).

The novelty of this contextual-based e-comics lies on its relevance to students' real lives, especially in the context of plantation areas. The novelty of this contextual-based e-comic lies in its relevance to students' real-life experiences, particularly within plantation areas. The material is delivered through visual narratives and interesting illustrations that are connected to daily life and the surrounding environment, making it easier for students to understand the material concepts. Our study is in line with Yanti et al. (2022) and Bouti et al. (2024) who emphasize the importance of a learning atmosphere that reflects students' own environments. Moreover, Nurhakim et al. (2024) suggest that analyzing storylines, characters, and messages in comics helps students enhance their critical thinking skills.

The practicality score results were obtained based on observations conducted by three observers during the learning process. As shown in Table 6, the practicality analysis over three meetings reached an average percentage of 89% and categorized as very practical. These results indicate that the contextual-based e-comic learning media are practical and easy to use in the science learning process. This is in line with the findings of Irawan and Hakim (2021), who state that a medium is considered practical if both teachers and students find the learning tools easy to implement, the material easy to understand, and aligned with the research design. This is in line with the findings of Irawan and Hakim (2021), who state that a medium is considered practical if both teachers and students find the learning tools easy to implement, the material easy to understand, and aligned with the research design.

The use of QR codes and direct links shared in WhatsApp class groups further enhances accessibility to the e-comics. Rahmasari et al. (2024) also support this, stated that e-comic media is more efficient as it saves time and energy which makes students can access the media simply by opening a PDF file or clicking a link. E-comic media are designed in the form of a flipbook with clear navigation, such as "next" and "back" buttons, zoom features to clarify illustrations, and GIF video link access features to support students' factual understanding. Heyzine as a web-based platform facilitates the creation of interactive flipbooks with added features such as videos, images, graphics, sounds, and links. These features provide students with a more engaging and immersive learning experience, particularly with the animation feature that simulates the experience of flipping through a physical book (Bhira et al., 2024).

The results of the pre-test and post-test analysis from 30 students were examined using the N-gain score to measure the improvement in students' critical thinking skills. As shown in Table 7, the N-gain analysis indicates an increase in learning outcomes and critical thinking skills, categorized as high after using the contextual-based e-comic media. This improvement is attributed to the structured design of the e-comics, which incorporates activities aligned with critical thinking indicators, therefore training students to think critically. Moreover, students are required to analyze the material presented in story form, which serves as a foundation for understanding the scientific concepts being taught. The use of comic media as a learning tool is enhanced through

contextual-based development, making it an effective medium for improving student learning outcomes (Astuti et al., 2021; Pinatih & Putra, 2021).

The effectiveness of the contextual-based e-comic learning media was also assessed through student response questionnaires. As shown in Table 8, the analysis of student responses yielded an overall percentage of 95% and considered into the very good category. The overall evaluation indicated highly positive responses from students across several components, including appearance and design, content, language, and usefulness. These findings are consistent with Yudea et al. (2024) which states that well-developed e-comic learning media are highly qualified and suitable for use in the learning process. Furthermore, comics that are systematically structured and supported by visual illustrations enhance students' understanding of complex material. As a result, they effectively address students' learning needs. The use of e-comics not only entertains students but also stimulates critical thinking which is an essential part of deep reasoning by sparking their curiosity and encouraging them to gain new insights (Yuniati et al., 2024).

CONCLUSION

Fundamental Finding: The results indicate that the contextual-based e-comic learning media developed resulted a very good criteria in the aspects of validity, practicality and effectiveness. **Implication:** The results of the N-Gain effectiveness score indicate that the contextual-based e-comics learning media can be used to improve the critical thinking skills of junior high school students in the plantation area. **Limitation:** The trial was limited to one group of students in the plantation area, so the generalization of the results to a wider population still needs to be studied further. **Future Research:** Lack of trial coverage by involving various schools in different environments to test the effectiveness of e-comics media, therefore it is necessary to expand trials for future researchers.

REFERENCES

Aprilia, T. (2021). The effectiveness of using contextual-based flipbook science media to improve students' critical thinking skills. *Journal of Educational Science Research*, 14(1), 10-21. https://doi.org/10.21831/jpipfip.v14i1.32059

Arianti, R., Indrawati, I., & Wicaksono, I. (2020). Effectiveness of animated video media for learning global warming in junior high school students. *EduFisika*, *5*(02), 92-103. https://doi.org/10.22437/edufisika.v5i02.10700

Astuti, T., Hidayat, S., & Rusdiyani, I. (2021). The effectiveness of comic media based on contextual learning to improve learning outcomes of third grade students at SD Negeri Karundang 2. *Journal of Educational and Learning Technology*, *8*(2), 150-164. http://dx.doi.org/10.62870/jtppm.v8i2.13124

Bhira, N. I., Suana, W., & Rinaldi, D. (2024). Development of heyzine-assisted interactive e-books on change materials. *Journal of Science Education Innovation (JIPS), 5*(2), 80-88. https://doi.org/10.51673/jips.v5i3.2186

Bouti, R., Wantu, A. W., & Wantu, S. M. (2024). Implementasi pembelajaran kontekstual dalam meningkatkan hasil belajar siswa pada mata pelajaran PPKn di kelas XI IPA SMA Negeri 7 Gorontalo Utara. *Jurnal Review Pendidikan dan Pengajaran (JRPP)*, *7*(3), 6395-6403. https://doi.org/10.31004/jrpp.v7i3.28123

Hake, R. R. (1998). Interactive-engagement versus traditional methods: a six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66*(1), 64-74. https://doi.org/10.1119/1.18809

Hendaryono, S. (2023). Efforts to improve students' critical thinking skills in mathematics learning trigonometric comparison material with the contextual teaching and learning (CTL) approach in class X MA Nurul Cholil Bangkalan. *Simki Pedagogia Journal, 6*(1), 245-256. https://doi.org/10.29407/jsp.v6i1.230

Herowati, H., & Azizah, L. F. (2020). Exploration of the kalianget coastal environment as a learning medium to support contextual science learning. *LENSA (Science Lantern): Journal of Science Education*, *10*(2), 137-156. https://doi.org/10.24929/lensa.v10i2.120

Irawan, A., & Hakim, M. A. R. (2021). Practicality of mathematics comic learning media on set material for class VII SMP / MTs. *Pythagoras: Journal of Mathematics Education Study Program*, *10*(1), 91-100. https://doi.org/10.33373/pythagoras.v10i1.2934

Jamaluddin, J., Jufri, A. W., Muhlis, M., & Bachtiar, I. (2020). Development of critical thinking skills instruments in junior high school science learning. *Journal of Pijar Mipa*, *15*(1), 13-19. https://doi.org/10.29303/jpm.v15i1.1296

Laksmi, L. P., & Suniasih, W. (2021). Development of e-comic learning media based on problem based learning on water cycle material in science content. *Journal of Education and Learning*, *5*(1), 56-64. https://doi.org/10.23887/jipp.v5i1.32911

Mukarromah, A., & Andriana, M. (2022). The role of teachers in developing learning media. *Journal of Science and Education Research, 1*(1), 43-50. https://doi.org/10.62759/jser.v1i1.7

Nadzif, M., Irhasyuarna, Y., & Sauqina, S. (2022). Development of interactive learning media for science based on articulate storyline on solar system material in junior high school. *JUPEIS: Journal of Education and Social Sciences*, *1*(3), 17-27. https://doi.org/10.55784/jupeis.vol1.iss3.69

Nafisa, N. Z., Dina, L. N. A. B., & Musthofa, I. (2023). Pengembangan media pembelajaran e-komik pada mata pelajaran pendidikan agama islam dan budi pekerti kelas XI materi prinsip ekonomi dalam Islam di SMA Negeri Jatirogo kabupaten Tuban. *Vicratina: Jurnal Ilmiah Keagamaan*, *8*(3), 203-216. https://jim.unisma.ac.id/index.php/fai/article/view/21070

Nuha, U., Wahyuni, S., Budiarso, A. S., Hasanah, U., & Anggraini, N. E. (2021). The effectiveness of flipbook and video to improve students' critical thinking skills in science learning during the covid-19 pandemic. *Lens: Journal of Physics Education*, *9*(1), 32. https://doi.org/10.33394/j-lkf.v9i1.3899

Nurhakim, S. S., Latip, A., & Purnamasari, S. (2024). The role of educational comic learning media in science learning. *A Narrative Literature Review. 14*(2), 417-429. https://doi.org/10.37630/jpm.v14i2.1551

Nurita, T., Ermawan, M. Z. F., Rizka, S. L., Hendratmoko, A. F. (2023). Analysis of critical thinking skills of junior high school students in science learning based on local wisdom on sound material. *IPA* XV 2023 *Education Seminar*.

Oktaviana, M., & Ramadhani, S. P. (2023). Development of digital comic-based science learning media to improve students' cognitive learning outcomes. *Scientific Journal of Education Profession, 8*(1), 48-56. https://doi.org/10.29303/jipp.v8i1.1090

Pinatih, S. A. Y., & Putra, S. (2021). Development of digital comic media based on the scientific approach to science content. *Journal of Educational Research and Development, 5*(1), 115-121. https://doi.org/10.23887/jppp.v5i1.32279

Putri, M. H., Fahmi, & Wahyuningtyas, E. (2021). Effectiveness of science learning tools to train critical thinking skills of junior high school students on the subject matter of static electricity. *Journal of Banua Science Education E*, *1*(2), 79-84. https://doi.org/10.20527/jbse.v1i2.13

Rahardhian, A. (2022). Review of critical thinking skills from a philosophical point of view. *Indonesian Journal of Philosophy, 5*(2), 87-94. https://doi.org/10.23887/jfi.v5i2.42092

Rahmasari, A., Handayani, D. E., & Sundari, R. S. (2024). Development of steam-based e-comic learning media on convection heat transfer around us in science content of grade V elementary school. *Educational Insights*, *4*(1), 102-114. https://doi.org/10.26877/wp.v4i1.16682

Sejati, W. S., Purba, H. S., & Mahardika, A. I. (2021). Development of web-based interactive learning media on learning the classification of matter and its changes in class VII SMP using the demonstration method. *Computer Science Education Journal (CSEJ)*, *1*(2), 37-48.

Sutarto, Prihatin, J., Hariyadi, S., & Wicaksono, I. (2021). Development of student worksheets based on STEM approach to improve students' critical thinking skills. *Journal of Physics: Conference Series*, *2104*(1). https://doi.org/10.1088/1742-6596/2104/1/012009

Yanti, F. A., Andaria, M., Rosa, F. O., & Sarah, S. (2022). Mapping the local potential of Kepahiang district, Bengkulu province for science learning (SMP/MTS). *Journal of Mipa Education*, *12*(1), 80-84. https://doi.org/10.37630/jpm.v12i1.548

Yudea, A. K., Suniasih, N. W., Bagus, I., & Surya, G. (2024). E-comic media based on auditory intellectually repetition on IPAS content of plant body parts material for grade iv students. *Journal of Education Action Research, 8*(3), 375-386. https://doi.org/10.23887/jear.v8i3.82788

Yuniati, R., Nulhakim, L., & Biru, L. T. (2024). Development of e-comic learning media with a scientific approach based on critical thinking of students on the material of the human respiratory system in class VIII junior high school. *Journal of Education, 14*(12), 1031-1041. https://doi.org/10.37630/jpm.v14i4.2075

***Dr. Iwan Wicaksono, S.Pd, M.Pd (Corresponding Author)**
Science Education Faculty of Teacher Training and Education,
University of Jember,
Jl. Kalimantan No. 37, Kampus Bumi Tegalboto, Jawa Timur, 60237, Indonesia
Email: iwanwicaksono.fkip@unej.ac.id

Muhammad Husni Farros
Science Education Faculty of Teacher Training and Education,
University of Jember,
Jl. Kalimantan No. 37, Kampus Bumi Tegalboto, Jawa Timur, 60237, Indonesia
Email: gan.farros223@gmail.com

Dr. Hjh Sallimah binti Hj Mohd Salleh
Sultan Hassanal Bolkiah Institute of Education,
Universiti Brunei Darussalam,
Jl. Tungku Link, BE1410, Brunei Darussalam
Email: sallimah.salleh@ubd.edu.bn

Dr. Yong Chin Chen
SM Pengiran Isteri Hajjah Mariam
Jl. Serasa, Brunei Darussalam
Email: yykb238@gmail.com

Ulin Nuha, S.Pd, M.Pd
Science Education Faculty of Teacher Training and Education,
University of Jember,
Jl. Kalimantan No. 37, Kampus Bumi Tegalboto, Jawa Timur, 60237, Indonesia
Email: ulin.fkip@unej.ac.id