ORBITA: Jurnal Pendidikan dan Ilmu Fisika
ISSN : 2460-9587 (print) | ISSN : 2614-7017 (elektronik)
Volume 12, Number 1, May 2026, pp. 44-52

Analysis of the need for e-comic development of light and optics material based on problem-based learning for students' learning styles

Rizki Dwika Septiarini*, Atika Anggraini

Natural Science Education Study Program, Faculty of Tarbiyah, Universitas Islam Negeri Syekh Wasil Kediri, Indonesia
*Correspondence: atikaanggraini@uinkediri.ac.id

Received: 07 April 2026 | Revised: 05 May 2026 | Accepted: 10 May 2026 | Published Online: 28 May 2026

Abstract

Education in the 21st century requires integration with digital technology to create engaging learning experiences aligned with students' learning styles. However, students often experience difficulties in understanding light and optics due to conventional teaching methods and limited learning media. This study aims to analyze the need for developing problem-based learning (PBL)-based e-comics on light and optics materials that suit students' learning styles. This research used a descriptive qualitative approach involving 32 students of class 8B at MTsN 6 Kediri and one science teacher. Data were collected through questionnaires to identify learning styles and interviews to examine learning difficulties and teaching practices. Data analysis was conducted using descriptive analysis of questionnaire and interview results.The results showed that students had difficulty understanding light and optics because learning was still conventional, physics was considered difficult, and media were not varied. Questionnaire results indicated that students tended to have visual learning styles. E-comics are appropriate as they present material through contextual visual stories and interactive elements, and can be integrated with PBL to support problem-solving and conceptual understanding. The findings indicate a strong need to develop PBL-based e-comics as an innovative learning medium that supports visual learning styles and improves students' understanding.

Keywords: e-comics; problem-based learning; learning styles.

How to Cite: Septiarini, R. D. & Anggraini, A. (2022). Analysis of the need for e-comic development of light and optics material based on problem-based learning for students' learning styles. *ORBITA: Jurnal Pendidikan dan Ilmu Fisika, 12*(1), 44-52. https://doi.org/10.31764/orbita.v12i1.39035

INTRODUCTION

The world of education is required to keep up with technological advances in this 21st century. Technological advances can influence cultural, social, and generational changes in Indonesia. The generation born between 1995 and 2010 belongs to the *digital native* generation, which is a generation that has been familiar with telephones, the internet, and various interactive applications since childhood (Muhammad Fadillah, Aulia Nurbalqis, and Lia Agustina 2022). Therefore, the world of education needs to adjust the learning process to the needs and characteristics of students. The learning process should not only be focused on conventional media, but also needs to utilize digital media in order to keep up with the times (Yuniarti et al. 2023). When compared to conventional learning, students tend to be more responsive to learning that utilizes technology (Setyawan, Sulthoni, and Ulfa 2019). Therefore, digital

learning media should not only be an option but also an essential requirement to adapt the learning process to students' needs in today's technological era.

The use of digital media can accommodate diverse learning needs, making learning more flexible, creative, and relevant to students' learning styles (Gunawan et al. 2024). The VARK model developed by Neil Fleming identifies four learning styles: *visual, aural/auditory, read/write,* and *kinesthetic*. This model can be used to understand the differences in students' diverse learning styles (Rais, Mulyastuti, and Anggraini 2025). Students who find it easier to understand material through pictures, diagrams, or colorful illustrations are classified as having a *visual* learning style. Meanwhile, students with an *aural/auditory* learning style usually find it easier to understand material through verbal explanations, discussions, or listening to audio recordings. Students with a *read/write* learning style easily understand material through notes and summaries. This is because the *read/write* learning style emphasizes reading and writing skills. Students with a *kinesthetic* learning style more easily understand material through direct experiences, which can include practice, experiments, and physical activities (Kasiono, Zulyadaini, and Yurni 2025). Understanding the diverse learning styles of students can help teachers select and combine appropriate digital media.

In science subjects, the use of digital media has a positive impact because many scientific concepts are abstract and require visualization to be well understood by students (Puspita Anggrini et al. 2024). Explanations using the lecture method make it difficult for students to imagine the scientific concepts being taught, so that the information provided by the teacher cannot be optimally conveyed to students (Nisa'i et al. 2022). Through digital media, abstract concepts can be visualized more realistically. In addition, students' interest in digital media can provide a pleasant learning experience for students, so that the material presented can be received optimally.

Observations made by researchers through interviews with 8th grade science teachers explain that students' enthusiasm for learning tends to be low in physics, especially in light and optics. Most students have disliked physics from the start, resulting in a lack of intrinsic motivation to participate in the learning process. This condition is caused by several things, including difficulty in understanding formulas, especially for students who are not good at math. In addition, the accompanying books used seem monotonous because they only contain formulas and scientific explanations, causing students to quickly become bored, lose focus, and have difficulty concentrating during learning. To increase students' enthusiasm for learning, 8th grade science teachers usually use textbooks and sometimes show educational videos from *YouTube.* This situation is reinforced by the researcher's observations of 8B MTsN 6 Kediri students through a questionnaire, which showed that students are more interested in books that have attractive, colorful, and interactive visual displays. Attractive learning media are believed to foster curiosity from the outset, make learning more enjoyable, and ultimately make it easier for students to understand the material on light and optics (Pratiwi and Ritonga 2023). Therefore, innovation in learning is needed, namely in the form of innovation in media and learning models.

One innovation in digital learning media that can be the answer to this need is e-comics. E-comics can present learning material in the form of interactive picture stories, thereby attracting students' attention from the outset. Richly colored visuals, interesting characters, and exciting storylines will make the learning process not only about learning theory but also feel like reading entertainment (Narestuti, Sudiarti, and Nurjanah 2021). Through e-comics, the concepts of light and optics can be presented in the context of everyday life, making them easier to understand and remember (Savitri and Kholiq 2023).

Engaging learning media will not be optimal without the right learning model to guide the learning process. Low student motivation due to monotonous learning can be overcome by applying *the problem-*

based learning model*. Problem-based learning* guides students to actively solve problems that are close to their daily lives (Darwati and Purana 2021). Combining digital comic learning media with *the problem-based learning* model will make the learning process more effective. Digital comics can be developed with storylines that incorporate scientific problems. This combination not only makes the learning media more appealing to the *digital native* generation but also ensures that the learning process aligns with students' learning styles.

Although previous studies have shown that digital media, including e-comics, can enhance students' interest and understanding, most of these studies tend to focus only on the effectiveness of the media itself without considering students' specific learning styles or integrating structured learning models such as problem-based learning (Narestuti, Sudiarti, and Nurjanah 2021; Savitri and Kholiq 2023). In addition, research on light and optics materials is still limited, particularly in studies that combine visual-based media with students' dominant learning styles. This indicates a research gap in the development of learning media that not only attracts attention but also systematically aligns with students' learning characteristics and supports higher-order thinking skills.

Furthermore, there is still limited research that specifically conducts a needs analysis as a basis for developing e-comics integrated with the problem-based learning model, especially at the junior high school level. Most studies directly develop products without deeply analyzing students' needs, learning styles, and classroom conditions. This lack of preliminary analysis may reduce the effectiveness and relevance of the developed media in real classroom settings.

Therefore, this study offers novelty by integrating three main aspects, namely students' learning styles, e-comic digital media, and the problem-based learning model, in the context of light and optics material. This study does not only focus on product development, but begins with a comprehensive needs analysis to ensure that the media developed is relevant, contextual, and in accordance with students' characteristics. This approach is expected to provide a more meaningful contribution to science learning, especially in improving students' conceptual understanding and engagement.

Given the importance of using digital media and its alignment with students' learning styles, this study aims to analyze the needs for developing an e-comic on light and optics based on *problem-based learning* tailored to the learning styles of 8th-grade students in class 8B at MTsN 6 Kediri.

METHODS

Type of Research and Approach

The approach used in this study is a comprehensive descriptive qualitative approach, in which the researcher plays an active role in the field, records every event that occurs, critically analyzes various documents found in the field, and compiles a detailed report (Seplyana et al. 2025). This approach was chosen to obtain an in-depth understanding of students' needs, learning conditions, and challenges in science learning, particularly in light and optics material.

Research Location

This research was conducted at MTsN 6 Kediri, focusing on class 8B as the primary setting of the study. The selection of this location was based on the relevance of the identified learning problems and the need for innovation in instructional media.

Data and Data Sources

The data collected by the researcher included students' obstacles in receiving learning, students' difficulties in understanding science subject material, students' interest in learning media, and students' learning styles. The data sources consisted of primary data obtained directly from students and the science teacher through questionnaires and interviews.

Research Subjects

This study involved 32 students of class 8B MTsN 6 Kediri and 1 science teacher. These subjects were selected because they are directly involved in the learning process of light and optics, making them relevant for identifying actual classroom needs.

Data Collection Techniques

Data collection was carried out through a survey technique using instruments in the form of interviews and questionnaires. The interviews were conducted with the 8th grade science teacher to find out the facts in the classroom during the learning process based on the teacher's perspective and experience, while the questionnaires were given to 32 students of class 8B MTsN 6 Kediri to find out the facts in the classroom during the learning process based on the students' perspective and experience. The questionnaire was also used to identify students' dominant learning styles based on the VARK model.

Data Analysis Techniques

The data obtained through interviews and questionnaires were then analyzed to identify the needs for developing e-comic media on light and optics based on problem-based learning for 8B students, interpreted comprehensively, and used as a basis for drawing conclusions. The analysis was conducted using descriptive qualitative techniques, including data reduction, data presentation, and conclusion drawing to ensure systematic and meaningful interpretation of the findings. Furthermore, to ensure the validity of the data, this study employed triangulation techniques by comparing data obtained from different sources, namely the science teacher and students, as well as different data collection methods, including interviews and questionnaires. This triangulation process was carried out to enhance the credibility and trustworthiness of the research findings.

RESULTS AND DISCUSSION

The analysis of the needs for developing e-comics on light and optics based on problem- based learning was conducted through direct observation in the field. The observation was conducted on 32 students in class 8B of MTsN 6 Kediri in the form of a questionnaire and 1 science teacher in class 8 in the form of an interview in September 2025. The results of the interview analysis with the science teacher in class 8 are described in Table 1.

Table 1. Results of the Analysis of the Interview with the 8th Grade Science Teacher

Media commonly used by teachers	• Educational videos from YouTube, phET (*virtual laboratory)*, simple experiments
Supplementary books in learning	• Modules and Erlangga packages (Excellent class)

	• Ministry of Education and Culture modules and books (regular class)
Teacher obstacles	• If students understand the material: enthusiastic • If students do not understand the material: unmotivated
Background Students do not understand the material	• Lack of intrinsic motivation from within the students because they did not like and were not interested in the material from the start • Lack of enthusiasm leads to poor focus and difficulty concentrating
Difficult material for students → light and optics	• Physics → difficulty imagining abstract concepts, low basic calculation skills, considering physics formulas difficult, students have no interest in physics material • Light and optics → Difficulty understanding scientific explanations, textbooks seem monotonous and only contain formulas
Teacher's solution	• Theory subject: connect to the real world (daily life), provide images students do not just listen (audio), but also see (visual) • Provide ice breakers • Evaluation (quizzes in the form of riddles) is given, which can be rewarded with extra points

The results of the interview analysis show that teachers usually utilize various learning media such as educational videos from YouTube, virtual laboratory simulations through PhET, and simple practical work in class. As a supplement, teachers use Erlangga modules and book packages for Excellent classes and modules and books from the Ministry of Education and Culture for regular classes. The variety of learning media used is an effort to maintain students' interest in learning (J. M. Dewi et al. 2025). Teachers need to be creative in making learning media so that they can adjust and read students' needs, so that the media used can support the learning process optimally (Meliyani et al. 2022). These findings are in line with previous studies which state that the use of varied and interactive learning media can increase students' motivation and engagement in the learning process. In the interviews conducted, the researchers found that the obstacle teachers faced in the learning process was that students would be enthusiastic when they understood the material, but when they did not understand the material, their enthusiasm for learning would decrease dramatically. The low level of student understanding was influenced by a lack of intrinsic motivation because from the beginning, some students did not like and

were not interested in physics, especially the material on light and optics. This makes students unmotivated, unfocused, and unable to concentrate (Sari, Sunarno, and Sarwanto 2018). Low interest in learning is one of the obstacles for students in accepting the material presented by teachers (Afriani, Simamora, and Puspadewi 2025). This result is consistent with previous research indicating that low learning interest significantly affects students' understanding and participation in science learning.

The material that students find most difficult is light and optics because they consider the physics formulas to be complicated, and students with low basic arithmetic skills will find it even more difficult to work on and understand this material. In addition, students are also not interested in textbooks that only contain formulas and scientific explanations without visual support. The books used as learning resources are one of the determining factors in fostering students' interest in learning (A. C. Dewi 2017). This is reinforced by interview data showing that teachers assess that students prefer learning accompanied by pictures, because it allows students not only to listen but also to see illustrations that facilitate understanding through the visualizations provided.

The researcher also conducted in-depth observations of students in class 8B at MTsN 6 Kediri by administering a questionnaire to determine students' learning styles and learning barriers. The results of the questionnaire analysis with class 8B students are described in Figure 1.

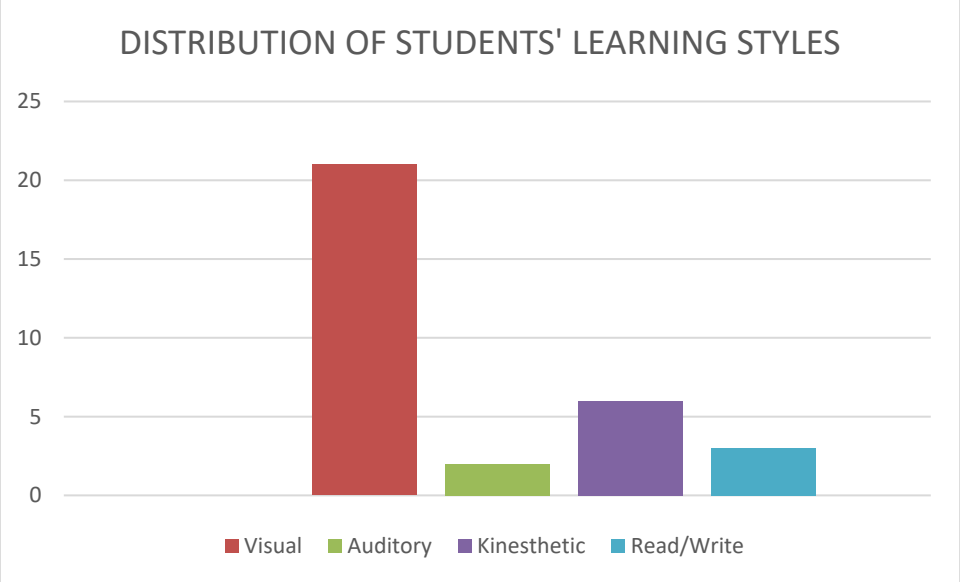

Figure 1. Diagram of learning styles of students in class 8B

From the questionnaire analysis data, it was found that 21 students had a visual learning style, 2 students had an auditory learning style, 6 students had a kinesthetic learning style, and 3 students had a *read/write* learning style, so the dominant learning style of students in class 8B was visual. The visual learning style emphasizes that understanding is enhanced when the learning process is delivered through images, illustrations, and visually appealing displays (Casmudi 2025). Visual learning focuses on the power of sight in understanding information. Through visually appealing displays, students can more easily remember information and clarify the relationships between the concepts presented. This finding supports previous studies which explain that students with visual learning styles tend to achieve better understanding when learning materials are presented through images and visual representations.

The researcher also found obstacles for students in class 8B in the learning process, including that many students felt that the teacher's explanations are unclear, especially when the material is delivered

only verbally. This makes it difficult for them to understand physics concepts, especially light and optics, especially when students are required to understand abstract concepts and apply formulas. Abstract concepts in science are ideas that are microscopic in nature and do not have a physical form, so they cannot be observed directly with the five senses (Salwa Sulaimah Nurhakim, Abdul Latip, and Shinta Purnamasari 2024). This is in agreement with previous studies stating that abstract concepts in science require visualization support to facilitate students' understanding. In addition, students also experience low concentration. This is because students feel bored because they are not interested in the material being taught. This situation is exacerbated by difficulties in understanding the questions and not understanding how to do the work, especially on questions that require reasoning or calculations. Low concentration makes it difficult to fully absorb the information conveyed by the teacher, resulting in limited understanding of the material (Adila, Sucipto, and Hilyana 2022).

The challenges in learning physics material on light and optics are not only due to concepts and formulas that are difficult to understand, but also due to students' low interest in learning (Isti'anah, Zaini, and Ilmiati 2024). Low interest in learning makes it difficult for students to understand the material even though teachers have tried to explain it in several ways. Therefore, teachers need innovative learning media that can attract interest and suit students' learning styles. For students with visual learning styles, media that emphasizes colorful illustrations and images will be more effective in improving their understanding of abstract concepts (Wulandari and Wardhani 2024). Through visual learning media, the material is not only imagined but also seen. Students with visual learning styles are able to absorb understanding more strongly through visualization than through text.

The learning process also needs to encourage students to be actively involved. When given problems to solve, students will be encouraged to seek information, investigate, and analyze. The learning model that suits these conditions is *problem-based learning*. Through *problem-based learning*, students are trained to find answers through the process of asking questions, exploring, and finding information (Ananti and Anggraini 2023). Learning activities that follow the structured syntax of *problem-based learning* can be a solution for students who have difficulty understanding the material.

Based on these conditions, *problem-based learning* e-comics are an appropriate alternative learning medium to be applied in class 8B. Unlike previous studies that generally focus on either media development or learning model effectiveness separately, this study emphasizes a needs analysis approach that integrates students' learning styles, digital e-comic media, and the PBL model specifically in the context of light and optics material. This integrated approach provides a more contextual and student-centered basis for developing instructional media, which distinguishes this study from previous research. Topics in light and optics, such as reflection, refraction, shadows, and the properties of light, are often difficult to understand when explained only through text and formulas (Anggraini, Aprima, and Siligar 2024). Digital comics can provide explanations through concepts with colorful illustrations, simple animations, and storylines that depict real phenomena, such as how mirrors work or how eyeglass lenses focus light. In addition, digital comics allow for the insertion of interactive elements, such as links to quizzes, problem-solving missions, or supporting videos, which can minimize student boredom in the learning process (Oktaviana and Ramadhani 2023). Interactive activities such as short quizzes and problem-solving challenges can reduce boredom levels so that various learning barriers can be overcome more comprehensively. These results are consistent with previous research which shows that the integration of digital comics and problem-based learning can improve students' engagement, critical thinking skills, and conceptual understanding.

CONCLUSION

Based on the results of the research conducted, it can be concluded that the development of e-comics on light and optics based on problem-based learning is needed to suit the learning styles of students in class 8B at MTsN 6 Kediri. The results of teacher interviews and student questionnaires show that most students have a dominant visual learning style, but still experience various obstacles such as unclear explanations from teachers, low interest in learning, and a lack of interest in textbooks that only contain formulas and scientific explanations. Teachers also emphasized that students find it easier to understand the material when it is presented through images or visually appealing media. These findings align with the need to develop e-comics that combine text, illustrations, and storylines based on problem-based learning. Thus, this needs analysis underscores the importance of developing e-comics as a learning medium that suits the learning styles of 8th grade students in class 8B.

REFERENCES

Adila, Amalia, Sucipto Sucipto, and F. Shoufika Hilyana. 2022. "Konsentrasi Belajar Siswa Pada Mata Pelajaran IPA." *Jurnal Educatio FKIP UNMA* 8(4): 1261–68. doi:10.31949/educatio.v8i4.3120.

Afriani, Ayuni, Br Simamora, and Kadek Rahayu Puspadewi. 2025. "PENERAPAN MODEL PEMBELAJARAN BERBASIS PROJEK UNTUK MENINGKATKAN MINAT BELAJAR SISWA." *Jurnal Santiaji Pendidikan* 15(2).

Ananti, Yoananda Ramadina, and Atika Anggraini. 2023. "Application of Multimedia Interactive Learning Based on Problem-Based Learning to Improve Students' Cognitive Learning Outcomes and Critical Thinking Skills." *Islamic Journal of Integrated Science Education (IJISE)* 2(3): 139–51. doi:10.30762/ijise.v2i3.1887.

Anggraini, Peni Nur, Desy Aprima, and E I Pusta Siligar. 2024. "Penerapan Model Problem Based Learning Berbantuan Media Konkrit Terhadap Kemampuan Pemahaman Konsep IPA Siswa Kelas V SD." *Journal of Education Research* 5(4): 4547–62. doi:10.37985/jer.v5i4.1605.

Casmudi. 2025. *Pembelajaran Diferensiasi Abad 21 : Konsep Pembelajaran Untuk Memenuhi Kebutuhan Siswa Dalam Transformasi Digital*. Yogyakarta: Karya Bakti Makmur Indonesia.

Darwati, IGA Mas, and I Made Purana. 2021. "Problem Based Learning (PBL) : Suatu Model Pembelajaran Untuk Mengembangkan Cara Berpikir Kritis Peserta Didik." *Widya Accarya* 12(1): 61–69. doi:10.46650/wa.12.1.1056.61-69.

Dewi, Anita Candra. 2017. "Pengaruh Minat Baca Dan Budaya Baca Terhadap Prestasi Belajar Siswa." 10(4): 429–33.

Dewi, Julia Marta et al. 2025. "Strategi Keterampilan Mengajar Guru Dalam Meningkatkan Minat Belajar Siswa." *Jurnal Al-Hasib: Manajemen Pendidikan Islam* 2(1): 99–107. doi:10.38048/jcp.v3i3.1831.

Gunawan, Ronny, Maya Zaina Billah, Rosiani Silalahi, and Henrik Tuka. 2024. "Gaya Belajar Gen Alpha Di Era Digital." *Dewantara : Jurnal Pendidikan Sosial Humaniora* 3(4): 277–97. https://jurnaluniv45sby.ac.id/index.php/Dewantara/article/view/3661.

Isti'anah, Thoyib Bakhtiar Zaini, and Ai Ilmiati Ilmiati. 2024. "Implementasi Strategi Minds Untuk Meningkatkan Pemahaman Dalam Pembelajaran Fisika Pada Siswa Smp." *urnal Pengabdian Masyarakat Berbasis Pesantren dan Madrasah* 3(1): 79–87.

Kasiono, Zulyadaini, and Yurni. 2025. *Pengantar Pendidikan Berbasis Budaya Berorientasi Masa Depan*. Klaten: CV. Sarnu Untung.

Meliyani, Azzah Risti, Diana Mentari, Gina Purnama Syabani, and Najwa Zalfa Zuhri. 2022. "Analisis

Kebutuhan Media Pembelajaran Digital Bagi Guru Agar Tercipta Kegiatan Pembelajaran Yang Efektif Dan Siswa Aktif." *Jurnal Jendela Pendidikan* 2(02): 264–74. doi:10.57008/jjp.v2i02.179.

Muhammad Fadillah, Aulia Nurbalqis, and Lia Agustina. 2022. "Pengaruh Konten Digital Terhadap Generasi Z Dalam Pemanfaatan Media Sosial Dan Digital Native Di Kota Tanjungpinang." *Al Yazidiy Jurnal Sosial Humaniora dan Pendidikan* 4(2): 01–11. doi:10.55606/ay.v4i2.29.

Narestuti, Agi Septiari, Diah Sudiarti, and Umi Nurjanah. 2021. "Penerapan Media Pembelajaran Komik Digital Untuk Meningkatkan Hasil Belajar Siswa." *Bioedusiana: Jurnal Pendidikan Biologi* 6(2): 305–17. doi:10.37058/bioed.v6i2.3756.

Nisa'i, Siti Haerotun, Harlinda Syofyan, Usnul Hotimah, and Rani Nurhayati. 2022. "Penggunaan Metode Ceramah Dalam Pembelajaran IPA Di Kelas Rendah Dan Tinggi." *Prosiding Esa Unggul* (9): 258–61.

Oktaviana, Miftha, and Sulistyani Puteri Ramadhani. 2023. "Pengembangan Media Pembelajaran IPA Berbasis Komik Digital Untuk Meningkatkan Hasil Belajar Kognitif Siswa." *Jurnal Ilmiah Profesi Pendidikan* 8(1): 48–56. doi:10.29303/jipp.v8i1.1090.

Pratiwi, Yeni, and Rudi Ritonga. 2023. "Pengembangan Media Pembelajaran IPA Berbasis Leaflet Untuk Meningkatkan Rasa Ingin Tahu Siswa." *Ideguru: Jurnal Karya Ilmiah Guru* 8(2): 276–81. doi:10.51169/ideguru.v8i2.521.

Puspita Anggrini, Rindy et al. 2024. "Inovasi Media Pembelajaran IPA Smart Book Sebagai Upaya Meningkatkan Kemampuan Kognitif Siswa Dalam Belajar Di MTS Tarbiyah Islamiyah Desa Kedemangan." *AJAD : Jurnal Pengabdian kepada Masyarakat* 4(3): 547–54. doi:10.59431/ajad.v4i3.397.

Rais, M. Amien, Herlina Mulyastuti, and Atika Anggraini. 2025. "Analisis Hubungan Antara Skor Dimensi Gaya Belajar VARK Dengan Pengetahuan Awal Mahasiswa Pada Konsep Biologi Dasar." *Pancasakti Science Education Journal* 10(1): 13–24. doi:10.24905/psej.v10i1.244.

Salwa Sulaimah Nurhakim, Abdul Latip, and Shinta Purnamasari. 2024. "Peran Media Pembelajaran Komik Edukasi Dalam Pembelajaran IPA: A Narrative Literature Review." *Jurnal Pendidikan Mipa* 14(2): 417–29. doi:10.37630/jpm.v14i2.1551.

Sari, Nurmalita, Widha Sunarno, and Sarwanto Sarwanto. 2018. "Analisis Motivasi Belajar Siswa Dalam Pembelajaran Fisika Sekolah Menengah Atas." *Jurnal Pendidikan dan Kebudayaan* 3(1): 17–32. doi:10.24832/jpnk.v3i1.591.

Savitri, Irma, and Abd Kholiq. 2023. "Validitas Komik Fisika Digital Untuk Melatihkan Berpikir Kritis Peserta Didik Pada Materi Gaya Gesek." *IPF: Inovasi Pendidikan Fisika* 12(3): 41–47. doi:10.26740/ipf.v12n3.p41-47.

Seplyana, Desy et al. 2025. *Metodologi Penelitian Dalam Evaluasi Pendidikan*. Bandung: Widina Media Utama.

Setyawan, Wahyu Candra, Sulthoni, and Saida Ulfa. 2019. "Pengembangan Multimedia Game Edukasi Ipa Lapisan Bumi Untuk Mts." *Jurnal Kajian Teknologi Pendidikan* 2(1): 30–36. http://journal2.um.ac.id/index.php/jktp/index.

Wulandari, Olivia Ayu, and Indah Setyo Wardhani. 2024. "Media Dan Gaya Belajar Siswa: Strategi Dalam Pembelajaran Efektif." *Jma)* 2(11): 3031–5220.

Yuniarti, Anisyah et al. 2023. "Media Konvensional Dan Media Digital Dalam Pembelajaran." *JUTECH : Journal Education and Technology* 4(2): 84–95. doi:10.31932/jutech.v4i2.2920.