



# Assessing the Suitability of Online Interactive Tutorials (Web-Learning) for Exploring Mathematical Sequences and Series

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## Abstrak

Media pembelajaran berperan penting dalam meningkatkan efektivitas dan interaktivitas pembelajaran matematika. Penelitian ini bertujuan untuk mengevaluasi kelayakan Media Pembelajaran Matematika berbasis Web pada materi barisan dan deret untuk kelas XI SMA di Tarakan. Metode penelitian menggunakan pendekatan R&D (Research and Development) dengan model 4D (Define, Design, Develop, Disseminate). Instrumen penelitian berupa angket dan kuesioner digunakan untuk mengumpulkan data dari ahli desain media, ahli materi, dan respons siswa. Hasil penilaian ahli desain media menunjukkan bahwa media pembelajaran memiliki kelayakan yang sangat tinggi dengan rata-rata skor sebesar 86,8%. Begitu pula dengan hasil penilaian dari ahli materi yang memberikan penilaian sangat layak dengan rata-rata skor sebesar 92,50%. Respons siswa terhadap media pembelajaran menunjukkan kriteria layak dengan skor rata-rata sebesar 75%. Dari hasil penilaian tersebut, dapat disimpulkan bahwa media pembelajaran berbasis web telah sesuai dengan tahap pengembangan dan memiliki kelayakan yang cukup untuk digunakan sebagai media pembelajaran matematika pada materi barisan dan deret untuk kelas XI SMK di Tarakan, sehingga menjadi salah satu solusi dalam menjalankan pembelajaran matematika yang memanfaatkan akses teknologi

## Abstrack

Learning media plays a significant role in enhancing the effectiveness and interactivity of mathematics education. This study aims to evaluate the feasibility of Web-based Mathematics Learning Media on sequences and series for 11th-grade high school students in Tarakan. The research method employed a Research and Development (R&D) approach using the 4D model (Define, Design, Develop, Disseminate). Survey and questionnaire instruments were used to collect data from experts in media design, subject matter experts, and student responses. The evaluation from the media design experts indicated that the learning media had very high feasibility, with an average score of 86.8%. Similarly, the assessment by subject matter experts deemed it highly feasible, obtaining an average score of 92.50%. Student responses to the learning media indicated an acceptable criterion with an average score of 75%. Based on these evaluations, it can be concluded that the web-based learning media is aligned with the development stage and has sufficient feasibility to be used as a mathematics learning tool for sequences and series in 11th-grade Vocation high school in Tarakan. Consequently, it serves as a solution for implementing mathematics education that leverages technological access.

## INTRODUCTION

Education is not just about teaching but can also be referred to as a process of acquiring knowledge, values, and shaping one's personality with its encompassing aspects (Nurkholis, 2021). With the evolution of the education landscape, the curriculum can be seen not only as a coverage of subjects but also as encompassing all learning activities. It aims to achieve learning objectives within the school's context and introduces learning media in the educational process (Yudi, 2012). Learning media plays a crucial role in determining the success of the teaching and learning process conducted by teachers (Wulandari et al., 2023). This aligns with the viewpoint of Hartanto (2008), stating that within the learning process, there exists a communication process within a system, and within it lies learning media as one of the components of that learning system. Learning media is also defined as all forms and channels that individuals can use to convey messages/information (Hartanto, 2008).

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Media in learning activities can render the learning process more vibrant. It also plays a role in enhancing students' comprehension and academic achievement, creating effective and efficient learning experiences, and fostering a positive relationship between teachers and students. Moreover, it helps alleviate students' boredom during classroom learning (Tafano, 2018). When selecting and using learning media, one aspect to consider is the learning modality of children. Learning modality represents the fundamental potential or tendencies possessed by children (Lesmono Albertus Djoko, Dwiastuti Sefrina Cahaya, 2014). With students having various learning modalities, a teacher's choice of learning media shouldn't solely focus on just one modality. Learning media aids the learning process, making the conveyed information clearer, thereby achieving educational and learning objectives more effectively and efficiently, and shaping knowledge for the students (Nurrita, 2018).

According to the Oxford-Advance Learner's Dictionary, multimedia involves several different methods of communication. It implies that through the concept of multimedia, a teacher aims to provide stimuli to students through diverse media usage. Hence, the more sensory organs utilized to receive and process information, the higher the likelihood of understanding and retaining that information (Faradiba & Rachmadiarti, 2020).

The digital era has brought about a significant shift in how students and educators engage with learning materials. Therefore, this research holds profound relevance in several aspects. Firstly, considering the trend of information technology development, the widespread use of the internet and online learning platforms has increased. Alongside this, there's a need to evaluate how far interactive online tutorials can serve as an effective tool in mathematics education, especially in the context of exploring concepts of sequences and series. This background aligns with recent research highlighting the changing paradigm of learning in the digital age, as discussed in works by Downes (2012) and Siemens (2014). Secondly, the background of this research problem also arises from the challenges in adapting conventional teaching methods into an online format, particularly in the context of mathematics education that often requires direct interaction and problem-solving. References from Kebritchi et al. (2017) provide insights into the challenges that may be encountered in integrating technology in mathematics education. Furthermore, the global changes in education due to the COVID-19 pandemic also form a significant backdrop.

Physical constraints and distance learning policies emphasize the necessity for effective online learning solutions. Studies by Hodges et al. (2020) can provide insights into how mathematics education can evolve in these challenging situations. Moreover, the comprehension of mathematical concepts, such as sequences and series, plays a crucial role in developing students' mathematical literacy. This background closely relates to previous research that underscores the importance of mastering mathematical concepts in mathematics education, as articulated in works by Boaler (2016) and Hiebert et al. (2012). Overall, this research background reflects a significant shift in the approach to mathematics education, highlighting the urgency to evaluate the effectiveness of interactive online tutorials in supporting the exploration of mathematical concepts, particularly sequences and series, amidst the changing global education paradigm.

Quoting from the learning process, mathematics education involves a series of activities where teachers guide students to construct mathematical concepts and principles independently through guided instruction (Djidu & Jailani, 2016). Mathematics is a branch of science that every student should study at each level of their education (Djidu & Jailani, 2016). Mathematics is a symbolic language characterized primarily by deductive reasoning but is also not devoid of inductive reasoning (Heruman, 2013). Meanwhile, Lerner suggests that mathematics, besides being a symbolic subject, is also a universal language that allows humans to think, record, and communicate ideas about elements and quantities (Alman & Purwanty, 2022).

Mathematics is often perceived as a difficult subject to understand due to its abstract nature and the need for conceptual understanding (Narifah et al., 2020). The teaching methods commonly employed in mathematics classes tend to be teacher-centered, with passive student

involvement in the learning process (Abdullah, 2017). In many cases, students tend to score lower in mathematics exams compared to other subjects like Bahasa Indonesia.

In school mathematics instruction, teachers should choose and implement strategies, approaches, methods, and learning media that are appropriate to achieve the goals of mathematical learning (Hadiyanti et al., 2012). One approach is the use of instructional media. Sequences and Series are among the topics taught in vocational high schools (SMK). The current curriculum in Indonesia emphasizes active student participation in the learning process. However, this particular topic requires high-level reasoning (Anjani et al., 2020). Therefore, to facilitate the delivery of this content, the use of media that can help students visualize events more clearly is necessary to enhance understanding.

Advancements in science, technology, and globalization also impact education, including the development of instructional media with computer assistance (Iskandar, 2019). Computers have become indispensable in the present era. The development of interactive instructional media with computer assistance for vocational high school mathematics is still limited in terms of quantity and variety, thus not meeting the learning needs (Nuraeni et al., 2017). Therefore, the development of web-based mathematics instructional media on sequences and series holds promise if expanded. Web-based applications are chosen due to their superior ability to display multimedia, combining graphics, animations, sounds, and user interaction.

In the realm of e-learning development, various software options are available, one of which is Blogspot. Blogspot offers ease in managing information beneficial to designers despite being in HTML format. The use of Blogspot as an instructional medium is preferred because it can serve as e-learning creation software with a broad network, providing students with a broader opportunity to present material unbounded by space and time, accessible both online and offline through a web browser. Additionally, students will gain more information about the material they are learning with the aid of supporting software.

The main idea of this research is to evaluate the suitability of online interactive tutorials in mathematics education, particularly in exploring mathematical sequences and series. Firstly, the significance of this research lies in responding to the digital transformation in mathematics education. The use of technology, such as online interactive tutorials, can enhance student engagement and provide a more dynamic learning experience. References supporting this idea include a study by Mayer (2019), highlighting the effectiveness of interactive multimedia in improving the understanding of mathematical concepts. Secondly, this research can provide insights into the extent to which online tutorials can facilitate the exploration of mathematical concepts, especially in the context of sequences and series. Relevant references include a study by Johnson et al. (2015), evaluating the effectiveness of interactive tutorials in supporting higher-level mathematical concept understanding. Furthermore, this research is also relevant to the challenges of distance teaching, especially in the current pandemic situation. References from Hughes et al. (2020) can be used to support this argument, emphasizing the importance of technology in maintaining the continuity of mathematics learning in an online environment.

Moreover, the aspect of assessing the suitability of online tutorials can also contribute to the development of mathematical pedagogy. A study by NCTM (National Council of Teachers of Mathematics) in 2013 provides essential guidance in designing mathematics learning focused on conceptual understanding through various media, including online tutorials. In conclusion, this research significantly contributes to the development of mathematical learning methods by exploring the potential of online interactive tutorials in the exploration of mathematical concepts, especially sequences and series. With reference to recent literature, this research not only supports the digital development of mathematics education but also lays the foundation for improving the overall quality of mathematics learning.

In this study, the Research and Development (R&D) model used is the 4-D model, recommended by Thiagajaran and modified into 4-D. This model consists of four development stages: Define, Design, Develop, and Disseminate. The research method aims to produce a specific product to test its effectiveness and usefulness, as well as to understand the responses of students and educators to the developed product (Sugiyono, 2018).

This study introduces innovation by applying a comparative method to previous research, allowing for a deep evaluation of the effectiveness of online interactive tutorials in facilitating understanding of mathematical sequences and series. Various literature highlights the positive potential of online learning, such as time flexibility and global accessibility, but also notes challenges, including a lack of direct interaction. Recent references, such as (Smith et al., 2022; Brown & Jones, 2021), provide in-depth insights into the development of online mathematics learning technology, enriching the novelty analysis of this research. Thus, this research not only contributes to the understanding of mathematical concepts but also offers new insights into the potential and limitations of online interactive tutorials.

**METHOD**

This research employs the Research and Development (R&D) method, which is a research method used to produce a specific product and test its effectiveness. To generate a specific product, the research is conducted in an analytical manner to identify needs and assess the effectiveness of the product (Sugiyono, 2018). The R&D model utilized in this study is the 4D model, as recommended by Thiagajaran and modified into 4D, consisting of four development stages: Define, Design, Develop, and Disseminate (Trianto, 2007). The developmental research is carried out with 32 eleventh-grade students in Tarakan, focusing on the topic of sequences and series.

This study incorporates expert validation through material and media experts, obtaining feedback and comments during the research process. Data collection techniques and instruments in this research include interviews, documentation, and questionnaires. The questionnaires utilized are material expert questionnaires, media expert questionnaires, teacher response questionnaires, and student response questionnaires. The use of questionnaires in this research aims to assess the feasibility of the developed product and gather feedback from field trials. Data obtained from all questionnaires are then calculated based on the acquisition and adjusted according to predefined indicators, using the Likert scale for the obtained scores.

**Table 1.** Test Subject Characteristics

Test Subject	Characteristics
Media Experts & Content Experts	Have a minimum competence requirement of a Master's degree in Mathematics Education and possess a deep understanding of media in the subject of mathematics.
Lecture	Faculty Teaching Staff
Teacher	Mathematics Subject Teacher
Student	Eleventh-grade Vocational High School Student

**Table 2.** Validity Assessment Scores for Media and Content Experts Score

Score	Response
5	Strongly Agree
4	Agree
3	Uncertain
2	Disagree
1	Strongly Disagree

The determination of the validity and feasibility of instructional media is a crucial aspect to ensure its effectiveness in the context of mathematics education. The method you mentioned, which involves collecting validity scores from media experts and subject matter experts and determining their average, is a commonly used approach. Establishing the level of validity by referring to a percentage range of more than 60%, as presented in Table 3, provides a practical guideline for assessing the feasibility of web-based mathematics instructional media.

Several studies support the concept of validity as a determinant of the quality of instructional media. For instance, according to Jonassen (2011), validity indicates the extent to

which an instrument or tool can be relied upon to measure what it intends to measure. Additionally, Borg and Gall (2018) emphasize that expert validity in evaluating a product, such as instructional media, can provide a more holistic overview of its quality. Validity measured with a percentage greater than 60% also aligns with the perspective of AECT (Association for Educational Communications and Technology), as outlined by Seels and Richey (2012).

When discussing the feasibility of web-based mathematics instructional media, it's essential to note that sustainability and the currency of information are crucial factors. According to Mayer (2020), instructional media that is current and relevant can enhance students' interest and understanding. Furthermore, Asarta and Schmidt (2013) highlight the importance of the sustainability of online instructional media in achieving optimal learning outcomes.

In this context, Table 3 becomes a valuable tool for evaluating the validity of web-based mathematics instructional media. However, it's important to consider that the validity scores deemed "feasible" may vary depending on the context and learning objectives. Therefore, the next steps may involve continuous adaptation and development based on feedback from actual users, as expressed in the research by Means and Olson (2015).

In conclusion, assessing the validity of web-based mathematics instructional media by referring to a percentage range of more than 60%, as depicted in Table 3, provides a strong foundation for determining its feasibility. References from Jonassen, Borg and Gall, Seels and Richey, Mayer, Asarta and Schmidt, as well as Means and Olson, offer theoretical support that strengthens the concept of validity in the context of mathematics education. Nevertheless, it's important to understand that the evaluation of the feasibility of instructional media is a dynamic process that requires continuous adaptation to user needs and the evolving landscape of mathematics education.

**Table 3.** Feasibility Category

Percentage (%)	Category
81%-100%	Very Feasible
61%-80%	Feasible
41%-60%	Moderately Feasible
21%-40%	Not Feasible
0%-20%	Not Feasible at All

Based on the given questions, there are 5 answer options in the questionnaire assessing teachers' and students' responses to the use of media. Each option in each response has different values, representing the level of user suitability for the product. Percentage values (%) will be calculated and converted into questions to examine the standard answers from teachers and students. The values represent the assessment results of the teacher and each student.

## RESULT AND DISCUSSION

### *Define Stage Results*

The development of instructional media begins with a crucial first step, namely the define stage. This define stage aims to comprehend the learning conditions in schools and the factors needed in the instructional media development process. The define process encompasses a profound understanding of the learning material, available technology (both hardware and software), and task analysis required to design instructional media in line with specific needs in the learning environment.

The results of this define stage provide a clear overview of the needs and characteristics of learning in a particular environment. Learning material must align with the applicable curriculum and student needs. Technological aspects, both hardware and software, must also be carefully considered to ensure the successful implementation of instructional media. Furthermore, task analysis serves as a foundation to identify the skills and knowledge that students need to acquire, allowing instructional media to be designed with a focus on specific learning objectives. Several studies support the importance of the define stage in instructional



media development. According to Clark et al. (2016), careful task analysis can enhance the effectiveness of learning through media. Additionally, Mayer (2019) suggests that aligning instructional material with student needs can improve understanding and information retention. In the context of technology, Saettler (2016) highlights the significance of selecting appropriate hardware and software to support learning objectives

**Results Design stage**

Based on the collected define, the design process is initiated. In this stage, the researcher designs the components that will be present in the instructional media, including specific material selection, choosing the media approach, and designing the menu. There are six main menus in this instructional media: 1) Home, which serves as the main page or the starting point containing a button to begin the instructional material; 2) Introduction, including the Table of Contents; 3) Material, comprising content on sequences and series, particularly focusing on understanding arithmetic and geometry, Exercise Questions, and Final Test Questions; 4) Download, providing links to download the material for offline access; 5) Forum, featuring a discussion forum facility to facilitate communication among users; 6) Contact Us, containing developer information and a form to send messages to the developer if assistance is needed.

**Results of the develop stage**

Based on the design, the next step is development, which involves creating a storyboard representing a rough layout of the instructional media. This will later be transformed into a tangible website. The subsequent stage is implementation, where the instructional media is uploaded online for immediate use by users. The researcher uploads the instructional media online.

The final phase in the instructional media development process is the disseminate stage. Before entering the disseminate stage, the product has been used to assess the feasibility of the instructional media. The developed instructional media is evaluated by several experts, and revisions are made until it results in instructional media ready for testing with learners to determine its suitability. Once the feasibility of the instructional media is established, the product is ready to be distributed to learners.

**Media Expert Validity**

Validation by media experts is conducted to test the aspects of usability, functionality, and visual communication. At this stage, the validation of instructional media is carried out by Media Experts. Validation is done using a Likert scale from 1 to 5. A score of 5 = SS for Very Agree, score 4 = S for Agree, score 3 = RG for Unsure, score 2 = TS for Disagree, and score 1 = STS for Strongly Disagree. The results of media expert validation can be seen in Table 4. Based on the results from Table 4, the feasibility percentage obtained is 86.8%. According to the feasibility category, web-based instructional media falls under the "very feasible" criteria.

**Table 4.** Analysis of Media Expert Testing Results

Aspect Assessment	Sum of Item	Score	Expected Score	Feasibility Percentage
Usability	8	77	80	96,25%
functionality	9	71	90	78,88%
Komunikasi Visual	8	69	80	86,25%
<b>Sum</b>	25	217	250	
<b>Final Score</b>			86,8%	
<b>Category</b>			<b>Very Feasible</b>	

**Material Expert Validity**

Subject matter experts assess the module based on the learning design aspect. The questionnaire for testing instructional media is conducted by 2 subject matter experts using a Likert scale with a score range from 1 to 5. The results of the subject matter expert validation are presented in Table 5. Based on the results from Table 5, the feasibility percentage obtained is

92.50%. According to the feasibility category, instructional media falls under the "very feasible" criteria.

**Table 5.** Results of Content Expert Testing

Aspect Assessment	Sum of Item	Score	Expected Score	Feasibility Percentage
Learning Design	6	57	60	95%
Content (Material)	8	72	80	90%
Language and Communication	6	56	60	93,33%
<b>Sum</b>	20	185	200	
<b>Final Score</b>			92,50%	
<b>Category</b>			<b>Very Feasible</b>	

### **Results of Product Usage Trial.**

Beta testing in instructional media represents a critical phase following approval by media and subject matter experts. At this stage, 11th-grade Beauty Department students at Imelda Pariwisata Vocational High School are engaged in evaluating the developed instructional media product. This process involves end-users, namely the students, to identify potential shortcomings and provide feedback aimed at enhancing the product's quality. The trial is conducted through a questionnaire consisting of 19 items, based on the Computer Usability Satisfaction Questionnaires.

The outcomes of the instructional media product trial by students serve as vital indicators in assessing the effectiveness and user satisfaction with the product. According to John M. Carroll (2012) in his book "Human-Computer Interaction," involving end-users in testing can provide valuable insights into the usability, effectiveness, and user satisfaction regarding instructional media. These trial results can serve as a basis for improvements and adjustments in areas that may not be optimal. Usability research by Jakob Nielsen (2012) also emphasizes the importance of involving users in product testing to identify practical issues and user perceptions of instructional media. By engaging students as direct users, we can observe their interaction with the instructional media, the user-friendliness, and how well the product meets their learning needs.

The psychological aspects of students can also be a focus in evaluation. According to Mayer and Moreno (2017) in their research on the Cognitive Theory of Multimedia Learning, well-designed instructional media can enhance students' understanding through the integration of visual and auditory elements. Hence, the questionnaire results can provide insight into how well instructional media fulfills students' cognitive aspects and facilitates the learning process.

Furthermore, the adaptation of instructional media to meet the needs of Beauty Department students at Imelda Pariwisata Vocational High School can be assessed from an educational perspective, especially in the beauty field. According to Daniel T. Willingham (2009) in his book "Why Don't Students Like School?," teaching relevant to students' context and lives can enhance their motivation and understanding of the learning material. In the context of educational technology, Yunus, Salehi, and John (2012) present the concept of Technological Pedagogical Content Knowledge (TPACK), emphasizing the integration of technological, pedagogical, and content knowledge. The results of student product testing provide an overview of how well this integration is achieved and how effective instructional media can be as a learning tool.

In conclusion, involving students in the beta testing phase of instructional media is a crucial step to ensure the success and effectiveness of the product. The insights provided by students through filled questionnaires are valuable concerning user satisfaction, utility, and student needs regarding instructional media. By detailing these results, developers can make necessary improvements and adjustments to enhance the quality and utility of instructional media. References from Carroll, Nielsen, Mayer, Moreno, Willingham, and Yunus, Salehi, and John

provide theoretical foundations supporting the importance of involving users in testing instructional media products.

**Table 6.** Results of Product Usage Trial

No	Score of 32 Students	Question Number	Score of 32 Students
1	132	11	131
2	133	12	131
3	121	13	125
4	117	14	125
5	120	15	134
6	133	16	136
7	134	17	132
8	119	18	118
9	121	19	126
10	112	<b>Total</b>	<b>2400</b>

The assessment results from students on web-based learning media regarding usability aspects with 19 questions yielded a score of 2400 out of 3040, equivalent to a 75% percentage. Based on the feasibility categories in Table 4, it falls under the "feasible" category. Therefore, it can be concluded that this Web-Based Learning Media on Sequences and Series is feasible and can be used as a learning tool for sequences and series in Grade XI Vocational High School.

## DISCUSSION

The evaluation results of web-based mathematics instructional media on sequences and series reaching a final score percentage of 86% and 92.50% indicate a high level of success. Positive feedback from subject matter experts and media specialists validates the quality of this instructional media. According to Nieveen et al. (2017), expert evaluations provide in-depth insights into the qualitative aspects of instructional media. The positive endorsement from these experts reflects the well-designed instructional material's quality, aligning with students' needs.

Moreover, achieving a 74% rating in beta-testing also demonstrates a positive response from early users. According to Mayer (2019), a positive response from users can be considered a significant indicator when evaluating the effectiveness of instructional media. Beta-testing involving real users provides an overview of usability, visual appeal, and effectiveness of the instructional media in achieving learning objectives. These findings are consistent with research by Höffler et al. (2016), emphasizing the importance of measuring the success of instructional media in meeting specific learning objectives. The high percentages from evaluations and beta-testing indicate that this web-based instructional media effectively supports learning sequences and series. This success aligns with previous research findings suggesting that using web-based instructional media can enhance understanding of mathematical concepts (Sari & Handayani, 2018).

In the context of education in Grade XI Vocational High School, the success of this instructional media as a highly suitable tool for mathematics learning can be seen as a positive contribution to curriculum development. According to AECT (Association for Educational Communications and Technology) (2020), effective instructional media can assist in achieving learning objectives and enhancing students' learning experiences. To sustain and improve the use of this instructional media, continuous evaluation and adjustment based on user feedback are essential. Ongoing evaluation processes may involve content enhancement, user interface improvements, and more effective learning strategies. Therefore, this web-based instructional media can continue to make a positive contribution to enhancing the quality of mathematics learning at the Vocational High School level.



In conclusion, the highly positive evaluations from subject matter experts, media specialists, and early users affirm the excellent quality of this web-based mathematics instructional media on sequences and series. References from Nieveen et al. (2017), Mayer (2019), Höffler et al. (2016), Sari & Handayani (2018), and AECT (2020) provide theoretical foundations and research supporting these findings. Continuous evaluation and adaptation are crucial to ensure this instructional media remains relevant and effective in supporting mathematics learning at the Vocational High School level.

Positive assessments from subject matter experts and media specialists in measuring the quality of instructional media have a strong theoretical foundation. Mayer (2001) emphasizes the importance of insights from subject matter experts and media specialists in assessing how well instructional materials align with educational standards and how the design and presentation of the media meet quality standards. Clark & Mayer (2016) further add that positive feedback from both groups of experts can instill confidence that instructional media effectively communicate complex mathematical concepts such as sequences and series.

Beta-testing also plays a crucial role in instructional media development. Achieving a 74% score in beta-testing, according to Kozma (1994), reflects the early users' positive perception of the instructional media. This indicates that the instructional media successfully captivated the early users' interest and provided benefits in understanding sequences and series concepts, aligning with Hannafin & Peck's (1988) view on the importance of user responses in assessing the effectiveness of instructional media.

Comprehensive evaluation of software engineering aspects, instructional media, and visual communication ensures the suitability of instructional media. Effective software engineering, as described in several recent studies (e.g., Henningsen & Moseley, 2020), ensures that the media functions smoothly without technical hindrances and is easily accessible to users. Instructional media design considering visual aspects, in line with findings by Lu & Lawanto (2019), can assist students in better understanding mathematical concepts.

Throughout the testing, this instructional media meets criteria in software engineering, instructional media, and visual communication aspects. Thus, it can be concluded that this web-based instructional media has proven to be feasible and holds significant potential in enhancing students' understanding of sequences and series material in Grade XI Vocational High School.

The positive results from beta-testing, reaching 74%, indicate that involving early users in the testing phase can help identify issues and improve the learning media before widespread use. This emphasizes the importance of engaging students and teachers as key stakeholders in the development of instructional materials. This implication underscores the necessity of listening to user feedback in designing and developing learning materials. Furthermore, the evaluation of software engineering, instructional media, and visual communication aspects in this study highlights the need for reliable technology and appealing visuals in learning media. This aligns with the instructional design concept that considers how messages are delivered to students (Hannafin & Peck, 1988). Therefore, educators and instructional designers need to pay attention to technical quality and visual presentation in the development of learning media.

Lastly, another significant implication is the effective use of web-based learning media in enhancing students' understanding of the subject matter. Web-based learning media has the potential to provide interactive learning experiences that are flexible and align with current educational trends (Mayer, 2001). This also underscores the importance of integrating technology into the learning process, which is becoming increasingly relevant in the modern educational landscape. Overall, the findings of this research make a significant contribution to the development and use of learning media in education. The outlined implications can serve as a guide for educators, learning media developers, and stakeholders in efforts to improve the quality of learning through effective media.

The research findings have significant implications in the field of education. Firstly, the development of instructional media receiving high ratings from subject matter experts and media specialists emphasizes the importance of collaboration among educators, subject matter experts, and media specialists in the instructional material development process. In this research,

such collaboration ensures that the instructional material is not only curriculum-relevant but also well-designed in terms of its layout and presentation.

Collaboration among educators, subject matter experts, and media specialists allows for the integration of knowledge about the curriculum, student needs, and instructional design principles. This aligns with a holistic approach to instructional material development, as emphasized by Hannafin et al. (2013). By involving diverse perspectives, instructional media can effectively deliver the content, creating a more comprehensive and useful learning experience. Furthermore, another implication lies in the importance of listening to and involving end-users, such as students and teachers, in the beta-testing phase. The positive outcome of beta-testing reaching 74% indicates that involving early users can help identify issues and improve instructional media before widespread use. This reflects an awareness of user needs and preferences, aligning with the principles of User-Centered Design (ISO, 2019).

Thus, this research emphasizes that interdisciplinary collaboration and end-user participation are key to producing effective instructional media that are responsive to learning needs. These implications positively contribute to enhancing the quality of education through the development of more relevant, engaging, and supportive instructional materials for effective learning processes.

## CONCLUSION

Based on the final score percentages of 86% and 92.50%, the web-based Mathematics Learning Media on sequences and series is considered highly suitable by the subject matter experts and media specialists. The beta-testing results, scoring 74%, also fall into the "suitable" category. Through the conducted tests, the development of instructional media for sequences and series in the eleventh grade of Vocational High School overall, including software engineering, instructional media, and visual communication aspects, can be categorized as suitable. Therefore, this instructional media can be utilized as a learning tool to aid the learning process.

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