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Development of Learning Media for Mathematics Students for Data Literacy Skills with the Help of Web Diffit

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Abstract:
The Industrial Revolution 4.0 encourages the integration of digital technology, including artificial intelligence (AI), into mathematics learning to support students' understanding of abstract concepts and develop essential digital-era skills such as data literacy. This study aims to develop mathematics learning media assisted by the Diffit Web platform to support students' data literacy skills in number pattern materials. The research employed a research and development (R&D) approach using the Borg & Gall model consisting of ten stages, including needs analysis, product development, expert validation, revision, limited trials, field testing, and dissemination. The validation results from material and media experts obtained scores of 93.47% and 92.89%, respectively, categorized as "very valid." The practicality assessment based on students' responses covering instruction clarity, navigation accessibility, and contextual relevance of data literacy increased from 94.25% to 95.55%, categorized as "very practical." Product effectiveness was evaluated through a post-test data literacy task in the field trial involving ten students. The assessment indicators included data interpretation, data representation, and conclusion-making based on data, resulting in a score of 96.66% categorized as "very effective." This score represents students' performance on the data literacy task after using the media and does not indicate learning improvement. Further studies with larger samples and pre-test–post-test designs are recommended.

Introduction (مقدمة)

The rapid development of the Industrial Revolution 4.0 has brought fundamental changes to almost all aspects of human life, including the education sector. This change requires adjustments to learning methods to keep pace with the rapid advancement of digital technology. The use of various types of media in the teaching and learning process, such as text, images, audio, and video, is aimed at building a more interactive learning atmosphere while having a positive influence on students' learning outcomes (Sabaruddin, 2022).

In line with this, the application of technology-based learning is considered to be able to strengthen students' understanding of abstract concepts, prolong their memory of the material, and arouse their enthusiasm for learning. The existence of digital technology in learning has also been proven to be able to boost the quality of the teaching and learning process through the provision of more varied, interactive, and contextual learning resources, as well as encouraging active participation of students, facilitating cooperation between educators and students, and allowing for quick and accurate feedback (Putriani & Hudaidah, 2021). Departing from these conditions, artificial intelligence or *Artificial Intelligence* (AI) is seen as a technology with great potential to be adopted in mathematics learning.

Mathematics is often referred to as the parent of all branches of science, so mastery of it is an important provision for every individual in applying this knowledge in daily life. One of the challenges faced in teaching mathematics is how to package material that tends to be abstract, such as number patterns, to be more interesting and easy to digest by students. Number pattern material has a crucial position because it is the foundation for understanding advanced concepts such as arithmetic, geometry, and algebra. However, in practice, this material is often seen as boring and difficult for students to understand.

Related to this problem, two groups of factors are considered to be the cause of low mathematics learning outcomes. The first factor comes from within the students themselves, such as weak motivation and interest in learning and less supportive health conditions. The second factor is related to teachers' teaching methods which are considered not sufficiently varied and have not answered the needs of students (Yanti & Supardi, 2022).

In addition to mastering mathematical concepts, data literacy skills are also an equally important skill to be developed in today's digital era. Data literacy can be interpreted as the ability to read, understand, analyze, and communicate information presented in the form of data, or in other words, the ability to "speak" through data. Considering that data is now present in almost all lines of life, from social media to business analysis, mastery of data literacy is a crucial provision for students in making more appropriate decisions, both in daily life and in the academic realm. Students who have adequate data literacy will be better prepared to face the demands of an increasingly competitive world of work, as well as being able to hone critical and analytical thinking skills in solving complex problems.

Answering these challenges, the integration of artificial intelligence-based digital learning media is starting to be looked at as a promising alternative solution. One of the platforms that has the potential to support this effort is *Web Diffit*, a generative AI-based service that is able to present learning materials in an adaptive, interactive, and tailored to the needs of teachers and students. *Web Diffit* provides more than 40 types of tools and content generators specifically designed for educators, ranging from the preparation of lesson plans, assessment rubrics, communication with parents, *Individualized Education Program* (IEP) documents, to math story problems.

Utilization *Diffit* can save teachers time in preparing differentiated teaching materials for students with diverse skill levels. The platform also helps teachers meet varied learning needs

through the provision of materials that can be adjusted to their level of difficulty, so that every student has an equal opportunity to understand the subject matter (Etikasari & Andayani, 2024).

Previous research findings also strengthen the urgency of using AI in the context of education. Application *Artificial Intelligence* able to stimulate students' understanding while encouraging their critical thinking skills (Annisa et al., 2024). AI-based learning media is also concluded to be an effective innovation in supporting students' learning independence (Mukti & Sudarmiani, 2024). In line with these two findings, the application of AI-based learning media applications has been proven to be able to significantly improve student learning outcomes (Kibari, Ratumbuysang, & Mansur, 2023).

Although prior studies have examined AI-based learning media in general (Annisa et al., 2024; Kibari, Ratumbuysang, & Mansur, 2023; Mukti & Sudarmiani, 2024) and the use of Diffit specifically in non-mathematics contexts, such as Indonesian-language instruction (Etikasari & Andayani, 2024), research that examines Web Diffit as a tool for developing data literacy within mathematics learning, particularly on number-pattern material, remains limited. Existing Diffit-related studies have not specifically addressed how the platform's generative features can be directed toward the distinct dimensions of data literacy (reading, interpreting, analyzing, and communicating data), nor have they examined the role of students' prompting competence as a precondition for effective use. This gap positions the present study as an attempt to extend the application of Web Diffit beyond general content generation toward a deliberately designed intervention for mathematics students' data literacy.

Departing from the various problems and findings that have been described, the researcher is encouraged to develop Web *Diffit AI-assisted learning media* on number pattern materials. The development of this media is expected to be able to increase students' understanding, arouse their motivation to learn, as well as answer the needs of technology-based learning that is relevant to the demands of the current digital era.

Based on this gap, this study formulates two research questions: (1) How does the Web Diffit-assisted learning media for Tadris Mathematics students' data literacy develop through the Borg & Gall procedure?, and (2) How effective is the resulting Web Diffit-assisted learning media in supporting Tadris Mathematics students' data literacy tasks? Based on these research questions, this study aims to design and test learning media for Tadris Mathematics students to support data literacy skills with the help of *Web Diffit*. This research is expected to make a dual contribution, namely: (1) Producing learning media for Tadris Mathematics students for effective and applicable Web Diffit-assisted data literacy skills . (2) To be a reference for Tadris Mathematics students as prospective educators in designing and compiling teaching materials that are effective and in accordance with the expected competencies.

Method (منهج)

This research uses a research *and development* approach that aims to produce a learning media product to improve the data literacy skills of Tadris Mathematics students with the help of *the Diffit* platform. This approach was chosen because the main purpose of research is not just to test a theory, but to create a product that is empirically tested and suitable for use in the learning process.

Development Model

Before determining the technical steps of product development, the researcher needs to refer to a frame of reference or development model as a conceptual foundation. The development model basically functions like an initial design or direction that guides the entire product creation process. There are three categories of development models that are commonly found in scientific studies, as stated by Puslitjaknov (2008). The first category is the procedural model, which is a

descriptive model that displays the concrete stages that must be passed in sequence to complete a product; this model can be likened to a cooking instruction that must be followed step by step. The second category is the conceptual model, which works by describing a product by its constituent components, then analyzing the relationships between these components. The third category is the theoretical model, which is based on established theories and supported by strong empirical evidence, so as to explain the scientific basis of every product development decision.

Based on these three categories, this study adopts a procedural model by following the development stages formulated by Borg & Gall (1989), considering its systematic and applicative characteristics to the development of learning media.

Development Procedure

Development procedure Borg & Gall (1984) consists of ten main stages that are mutually continuous. The first stage is *research and information gathering*, namely the process of collecting initial data and preparing a comprehensive research plan, including literature review, field observation, and identification of user needs. The second stage is research planning (*Research Planning*), where the researcher formulates the development objectives, user goals, and implementation framework in more detail.

The third stage is in the form of early *product development*, which is the preparation of an initial design of Diffit-based learning media that will be further tested. This design then goes through the expert validation stage as the fourth stage, where experts in the field of materials and media provide assessments and input on the feasibility of the product before it is tested to users. The input from the validation process becomes the basis for the fifth stage, namely the first stage of *product revision*, in order to correct the deficiencies identified before small-scale testing is carried out.

After the initial revision is completed, the product enters the sixth stage in the form of *an early test* in a small group to obtain practical feedback from users. The results of the trial are then used as a reference in the seventh stage, namely the second stage of product revision, before the product is tested in a wider group through the field *test* stage. This stage aims to ensure that the product developed can really be applied to more real and varied learning conditions.

Based on the results of the field trial, a *final product revision* is carried out as the final improvement before the product is declared ready for widespread use. The last stage of this entire procedure is dissemination, *which is the process of disseminating the final product so that it can be used in real terms in learning activities, especially in an effort to improve the data literacy ability of Tadris Mathematics students.*

The overall flow of these development stages can be briefly described as follows: initial information collection, research planning, initial product development, expert validation, product revision, initial trial, second revision, field trial, final product revision, and product dissemination (see Figure 1).

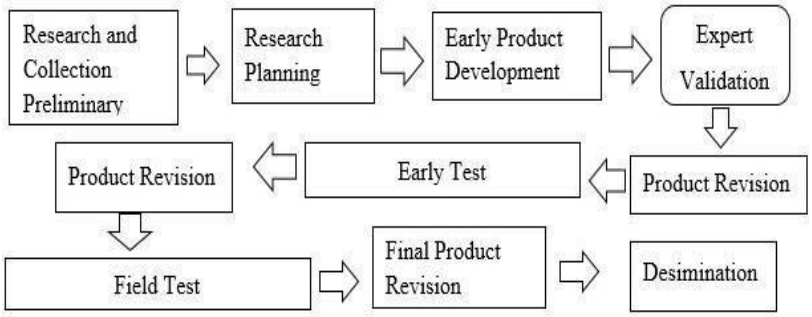

Figure 1. Research Flow of Borg & Gall Model Development

Justification for Model Selection

The selection of the Borg & Gall procedural model in this study is based on the consideration that the model provides clear and measurable stages, making it easier for researchers to control product quality at each stage of development. In addition, the existence of expert validation stages and multi-stage trials—both on a small scale and on a large scale—allows the resulting product to undergo continuous improvement based on empirical data, rather than just the researcher's assumptions. This is in line with the view that Puslitjaknov (2008) which confirms that the success of a development product is largely determined by the extent to which the development process is based on systematic and tested procedures. Thus, the entire process of developing assisted learning media *Diffit* In this study, it is designed to follow a flow that has been proven effective in various previous development researches, as well as adjusted to the context of the data literacy needs of Tadris Mathematics students as the main target of developing this product.

Participants

The participants in this study were students of the Tadris Mathematics Study Program at UIN Sulthan Thaha Saifuddin Jambi who were involved in each stage of the product development process. Participant selection used a **purposive sampling technique** based on the requirements of each testing stage. In the expert validation stage, two experts were involved, consisting of a mathematics subject-matter expert and a learning media expert. The experts were selected based on their competence in mathematics education, learning materials, and digital learning media.

The individual trial involved three students representing different levels of mathematical ability (high, medium, and low). The classification of students' ability levels was determined based on their previous academic achievement in mathematics courses and recommendations from the lecturer. This selection aimed to obtain diverse feedback regarding the readability, usability, and accessibility of the developed Web Diffit-assisted learning media.

The small-group trial involved six students selected from the Tadris Mathematics Study Program to evaluate the practicality and user responses toward the developed media. Furthermore, the field trial involved one class consisting of ten students who had no previous experience using AI-based learning media. These participants were selected to evaluate the effectiveness of the developed product through students' performance on data literacy tasks after using the Web Diffit-assisted learning media.

Research Instruments

Data were collected using three instruments. First, a validation sheet using a 1–4 rating scale and qualitative comments was used to evaluate the validity of the developed media. The validation instrument consisted of two assessment components: material expert validation and media expert validation. The material expert instrument consisted of 10 assessment items covering mathematical content accuracy, suitability of number pattern concepts, and data-literacy aspects. Meanwhile, the media expert instrument consisted of 10 assessment items covering the accuracy of Web Diffit features, media design, interactivity, and accessibility.

Second, a practicality questionnaire was administered after the main trial and small-group trial to evaluate students' responses toward the developed media. The questionnaire consisted of 11 items grouped into three aspects: (1) clarity and ease of use of instructions and media navigation, (2) efficiency of time and learning support, and (3) relevance of the data-literacy context in supporting students' understanding.

Third, a post-test was administered after the field trial to measure product effectiveness. The post-test consisted of data literacy tasks designed based on three indicators: (1) interpreting data presented in tables or diagrams, (2) representing data into appropriate forms, and (3) drawing conclusions based on data analysis. The post-test results were used to determine the effectiveness of the Web Diffit-assisted learning media and did not represent learning improvement because no pre-test was administered.

Validity, Practicality, and Effectiveness Criteria

The data obtained from the validation sheets, practicality questionnaires, and effectiveness tests were analyzed using percentage calculations. The percentage score was calculated by comparing the obtained score with the maximum possible score using the following formula:

$$P = \frac{\sum x}{\sum x_{max}} \times 100\%$$

where Prepresents the percentage of the assessment score, $\sum x$represents the obtained score, and $\sum x_{max}$represents the maximum expected score.

The obtained percentage scores were then interpreted based on the criteria adapted from Akbar (2013), as presented in Table 1.

Table 1. Interpretation Criteria of Product Quality

Percentage Range	Category
81–100%	Very valid / Very practical / Very effective
61–80%	Valid / Practical / Effective
41–60%	Fairly valid / Fairly practical / Fairly effective
21–40%	Less valid / Less practical / Less effective
0–20%	Invalid / Impractical / Ineffective

A product was considered feasible for implementation when the validation and practicality results reached the "very valid" and "very practical" categories. Meanwhile, the effectiveness of the developed Web Diffit-assisted learning media was determined based on students' achievement in the post-test data literacy task, with the percentage score interpreted according to the same criteria.

Data Analysis Technique

Quantitative data obtained from the validation sheets, practicality questionnaires, and post-test were analyzed descriptively using percentage scoring. The percentage score was calculated using the following formula:

$$P = \frac{\sum X}{\sum X_{max}} \times 100\%$$

where **P** represents the percentage score, **ΣX** represents the total score obtained from the assessment, and **ΣXmax** represents the maximum possible score.

The obtained percentage scores were then converted into qualitative categories based on the interpretation criteria adapted from Akbar (2013), including very valid, valid, fairly valid, less valid, and invalid categories. The same criteria were applied to interpret the practicality and effectiveness levels of the developed learning media.

Qualitative data obtained from experts' suggestions, comments, and field observations were analyzed descriptively through thematic analysis. These data were used as references for improving and revising the Web Diffit-assisted learning media during each stage of the development process.

Results (نتائج)

Results of Needs Analysis and Preparation Stage

The initial stage of this research began with an analysis of the needs of potential users which was carried out through observation and distribution of questionnaires to students of the Tadris Mathematics Study Program. This activity aims to collect initial data as a basis for designing Diffit-based mathematics learning media to support data literacy skills. The findings of this process lead to three main things, namely the difficulties of students in understanding the concept of data literacy and abstract mathematical materials such as number patterns, the need for adaptive interactive teaching materials, and the importance of using *Artificial Intelligence* (AI)-based digital media to increase learning motivation.

In addition to the needs survey, the researcher also carried out a literature study and *benchmarking* of existing AI-based media development models, as well as examined relevant *Web Diffit* features to support the preparation of materials. The results of the series of activities at this preparation stage show that there is a significant gap between the demands of data literacy mastery and the learning practices that have been taking place, which are considered to be still less varied and have not utilized technology optimally. These findings are then used as a blueprint for researchers to enter the product design and development stage.

Initial Product Development Results

The learning media product is designed through *the Diffit Web* platform by utilizing the *Generative AI* feature available in it. Development begins by entering the topic of the material, namely data literacy and number patterns, which is then processed by the system using one of more than forty content generation tools so that draft teaching materials in the form of reading frameworks, explanatory texts, and math story problems are automatically obtained.

The content produced by the system is then customized and differentiated to suit the characteristics of Tadris Mathematics students, both in terms of the level of difficulty of reading and the questions presented. In the final stage of initial development, the material that has been compiled is exported into digital form and distributed through *the Liveworksheet platform* so that it can be accessed through various electronic devices. The product produced is in the form of a data literacy E-LKPD in the context of the commemoration of the Independence Day of the Republic of Indonesia, which is designed for junior high school/MTs Phase D levels as part of a teaching material simulation.

Figure 2. Initial design display of Diffit Web-based data literacy E-LKPD**,** containing material covers and interactive worksheets with the theme of the Independence Day competition]

Initial Trial Results (Expert Validation)

The finished product was then validated by two experts, namely a math subject matter expert and a learning media expert, using a validation sheet on a scale of 1-4 accompanied by qualitative notes in the form of suggestions for improvement. The material expert was in charge of assessing the accuracy of mathematical concepts, especially number patterns and data literacy aspects, while the media expert assessed the accuracy of the use of *the Diffit Web feature*, the level of interactivity, and the ease of access to AI-based material. The results of the assessment showed that the material expert gave a score of 93.47%, while the media expert gave a score of 92.89%. These two values placed the product in the category of "Very Valid and Suitable for Use with several revisions".

Results of the First Phase of Revision

Based on the notes of the two validators, a number of improvements were made to the media prototype. The subject matter expert recommended strengthening statistical content as the foundation of data literacy, by adjusting the complexity of the data and adding real context so that students are not only calculating, but also able to analyze and interpret data critically. The media expert recommends the addition of an *interactive writing* feature so that users can write answers and analysis notes directly on the application screen without having to move to a separate worksheet.

Key Test Results

After being valid, the product was tested on three students of the Mathematics Department with various levels of ability (high, medium, low) individually and gradually. Data was collected through a practicality questionnaire that explored three aspects, namely the clarity of instructions for use, the ease of navigation of digital platforms, and the effectiveness of the data literacy context in helping understanding. The results of the accumulated practicality questionnaire at this stage showed a figure of 94.25% with the category "Very practical".

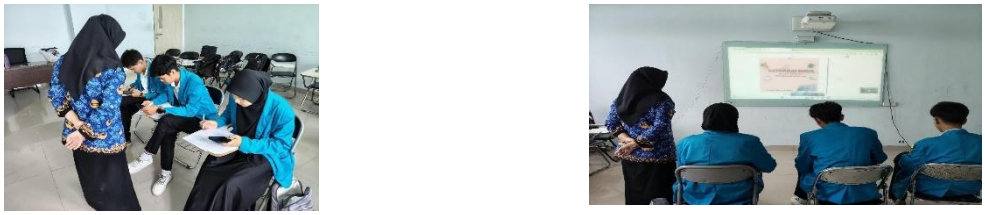

Figure 3. Documentation of the main test activities with individual Mathematics students

Revised Results

The implementation of the main trial on a wider scale revealed a number of technical obstacles, including navigation buttons and hyperlinks of *unclickable* material that hinder the movement of topics, as well as malfunctions of the digital answer input feature that caused *the typing feature* to be inactive on a number of devices. These findings are the basis for a thorough improvement of the navigation code and compatibility of *the interactive writing* feature before the product is tested at the next stage.

Final Test Results

The final trial or small group test involved six students of the Mathematics Department who used the product simultaneously in an atmosphere resembling a real lecture. The researcher observed student interaction with *the Web Diffit adaptive feature* as well as the pattern of group discussions related to the material, number patterns, and data literacy. The results of the accumulated practicality questionnaire at this stage reached 95.55% with the category "Very practical", and the results were used as the basis for the last major revision before the product entered the field test stage.

Figure 4. Documentation of small group trial activities *of* Web Diffit-assisted *learning media*

Deployment Results (Field Trials)

The field *test* stage involved a full class of ten students who had never used AI-based media before. The implementation was preceded by ensuring the readiness of the digital infrastructure, then continued with a learning session led by the teaching lecturer with the assistance of the researcher as a facilitator. The effectiveness of the product was measured using a *post-test* after the treatment. The results showed that the majority of students were able to understand the use of *Web Diffit* in solving number pattern problems, although a small number still experienced obstacles due to a lack of familiarity in compiling appropriate instructions (*prompting*). The cumulative result of the overall media effectiveness reached 96.66% with the category "Very Effective". It should be noted that effectiveness was measured through a single post-test administered after treatment, without a pre-test comparison; therefore, this score should be interpreted as an indicator of the product's effectiveness in the post-treatment condition rather than as direct evidence of data-literacy improvement.

Figure 5. Documentation of learning media dissemination activities (*field tests*) in the Mathematics Study Program]

Discussion (مناقشة)

Diffit Web-Assisted Learning Media Development Process

Referring to the formulation of the first problem regarding the development process of learning media, the findings of this study show that development takes place through systematic stages, starting from the identification of needs, product design, expert validation, to a series of multi-level trials. The gaps found at the preparation stage, namely the lack of variation in data literacy learning methods and the limitations of technology utilization, are in line with the view that number patterns are fundamental materials that are the basis for understanding advanced mathematical concepts such as arithmetic and algebra, so mastery of them needs to be built from the beginning firmly (Suherman, 2003). This problem is exacerbated by the fact that less innovative and interactive learning methods are often the main cause of students' difficulties in understanding number patterns (Hadi & Dedyerianto, 2020), so that the presence of adaptive learning media such as *Web Diffit* is a relevant answer to this problem. This condition also strengthens the finding that students' digital literacy abilities are basically still diverse and are greatly influenced by the extent to which students are accustomed to interacting with digital learning resources from the beginning of the lecture period (Dinata, 2021), thus strengthening data literacy through the media *Web Diffit* can be one of the systematic efforts to bridge the gap.

The process of customization and differentiation of the material carried out by educators after the basic content is generated by the system *Generative AI* emphasized that artificial intelligence-based technology is able to adjust materials and delivery methods according to user needs, so that it can increase learning motivation as well as overall learning effectiveness (Sartika, Sujana, & Fitriyani, 2022). In other words, the role of technology in this development does not completely replace the function of educators, but rather becomes a tool that accelerates the preparation of teaching materials while providing room for adjustment of the level of material difficulty for students with diverse abilities. Patterns of relationships between educators and systems *Artificial Intelligence* This kind of also confirms that readiness (*Readiness*) educators in integrating AI into teaching practices is a determining factor for success, as it was found that the intention and readiness of educators to teach and utilize artificial intelligence is greatly influenced by their perception of usefulness and confidence in the technology (Ayanwale, Sanusi, Adelana, Aruleba, & Oyelere, 2022).

The expert validation stage showed the results of "Very Valid and Suitable for Use with Several Revisions", both from the material aspect (93.47%) and the media aspect (92.89%). Qualitative input from material experts who emphasized the need to strengthen statistical content as a foundation for data literacy is basically in line with the finding that the identification of learning difficulties in number pattern material can be used as a basis for designing more effective learning materials and methods in overcoming these obstacles (Agustian & Salsabila, 2021). This shows that the process of automatic generation by AI still requires human curation so that the depth of scientific substance is not reduced by mere technological practicality.

A series of field trials that were carried out in stages starting from the main trials, the revision of the findings of technical constraints such as unresponsive navigation buttons and feature glitches *Typing*, to small group trials showing a consistent pattern of increasing the practicality value, from 94.25% to 95.55%. This improvement confirms that the revision process based on real user feedback makes a real contribution to product improvement. The development of this kind of artificial intelligence-based media is basically in line with the direction of education policy 4.0 which places technological innovation as an important element in supporting competency-based learning (Ministry of Education and Culture, 2019), so that the development steps taken by researchers can be seen as in line with the demands of digital transformation in the world of education today.

The Effectiveness of Diffit-Assisted Learning Media on Data Literacy Ability

Referring to the formulation of the second problem regarding the effectiveness of the product, the findings at the field trial stage (*Field Test*) shows that the learning media is aided by *Web Diffit* obtained an effectiveness score of 96.66% with the category "Highly Effective". These findings reinforce the view that the integration of digital technology into the mathematics learning process can increase students' active involvement during the learning process (Awaliyyah, Sutrisno, & Kirana, 2021), as can be seen from the enthusiasm of students observed during the implementation of *Field Test* towards the use of artificial intelligence-based media that offers new and interactive learning experiences. This achievement also illustrates that the application of *Generative Artificial Intelligence* In the context of education, it does have the potential to have a multidimensional impact, both on the way students access the material, the way they interact with the content, and the way they build new understandings independently (Dwivedi et al., 2023).

This high effectiveness achievement also confirms that AI-based learning media that are specifically designed to meet the needs of their users tend to be able to provide optimal learning outcomes, as shown in the development of AI-based applications to help students with certain learning needs understand abstract concepts in a more concrete way (Etikasari & Andayani, 2024). Similar principles apply to the use of *Web Diffit* in this study, where the material on number patterns and data literacy that was originally abstract can be visualized to be easier to understand for students of the Mathematics Department.

However, the findings regarding the existence of some students who have not fully mastered the material need special attention. Based on the results of in-depth interviews, these obstacles stem from the lack of familiarity of students in compiling instructions (*Prompting*) to the AI system, so that the data output obtained is less accurate. This condition shows that the successful use of generative AI-based tools, as well as the development of learning videos using *Pictory AI* that have proven to be effective in delivering complex material in certain courses (Kibari et al., 2023), is largely determined by the readiness of its users to operate the technology appropriately, not solely on the sophistication of the available features. In fact, findings from large-scale field experiments in mid-level mathematics learning show that the use of *Generative AI* without a safety mechanism (*Guardrails*) that are adequate, for example, a system that directly provides the final answer without encouraging the thought process, can actually reduce students' learning outcomes when access to AI is eliminated (Bastani et al., 2025). These findings reinforce the importance of assistance in the preparation of *prompt* as found in this study, so that students do not just passively accept AI outputs, but remain actively involved in the critical thinking process.

Viewed through the lens of data literacy as a multidimensional construct—encompassing the ability to read, interpret, analyze, and communicate data—the features of Web Diffit appear to support these dimensions unevenly. The platform's generative reading materials and adaptively differentiated content primarily support the reading and interpreting dimensions, while the interactive writing feature introduced after expert validation provides a channel for the communicating dimension, allowing students to articulate their analysis directly within the application. However, the analyzing dimension—students' ability to critically examine and draw conclusions from data rather than merely process AI-generated output—appears to be the most dependent on prompting competence, and is precisely where the observed obstacles were concentrated. This suggests that the effectiveness of Web Diffit in strengthening data literacy is not uniform across its components, and that without adequate prompting skills and lecturer supervision, students risk engaging with the surface features of the media rather than with the underlying analytical demands of data literacy. This observation reinforces the need to treat AI-

generated content as a starting point requiring verification and guided interpretation, rather than as a final, authoritative output.

Thus, it can be said that the competence *Prompting* is an integral part of data literacy itself in the context of generative AI-assisted learning. This is in line with the spirit of AI-based media development that emphasizes the importance of personal feedback and user learning independence, as seen in the development of AI-based e-portfolios designed to improve students' learning independence through more personalized and effective feedback (Mukti & Sudarmiani, 2024). In addition, the need for strengthening *AI literacy* prospective educators are also in line with the results of the study which highlights that artificial intelligence literacy in teacher education is still an area that needs to be continuously developed so that prospective educators are able to use AI technology critically and responsibly, not just as passive users (Sperling et al., 2024). Therefore, the aspect of students' digital literacy readiness needs to be explicitly introduced before or at the same time as the use of media so that the learning results obtained are truly optimal.

When examined gradually, there is a trend of increasing scores in each testing phase, starting from expert validation (92–93%), main trials and small group trials (94–95%), to effectiveness tests at the deployment stage (96.66%). This consistent increase pattern confirms that digital technology-based learning media, as well as the development of AI-based video media, has been proven to be able to make the learning process more interesting and effective in improving the ability of its users (Annisa, Nasution, Nuran, & Yusuf, 2024), indeed has great potential to continue to be refined through repeated revision cycles that involve real users at every stage.

Taking into account the results of validity, practicality, and effectiveness which are consistently in the very high category, it can be stated that the Web Diffit-assisted mathematics learning media developed in this study is proven to be able to answer the needs of Tadris Mathematics students in improving data literacy skills, as well as being relevant to be disseminated more widely as an example of teaching material innovations based on artificial intelligence technology within the Tadris Mathematics Study Program.

Conclusion (خاتمة)

The development of Web Diffit-assisted *mathematics learning media* on number-pattern material was carried out through ten sequential stages of the Borg & Gall model, from needs analysis to dissemination, answering the first research question. Regarding the second research question, the product proved valid (material: 93.47%; media: 92.89%), practical (increasing from 94.25% to 95.55% across trials), and effective in the post-treatment field test (96.66%). These three indicators should be read as distinct forms of evidence: validity and practicality reflect expert and user judgments of the product itself, whereas the effectiveness score reflects students' performance on a single post-test involving only ten participants, without a pre-test comparison. Claims regarding the improvement of students' data literacy should therefore be stated cautiously and treated as preliminary. Given the recurring obstacle of students' limited competence in compiling *the right prompts* when interacting with *the Generative AI* system, digital literacy and *prompting competency* assistance should be provided explicitly before the media is used more widely, alongside continued lecturer supervision of AI-generated content. Future research is recommended to involve larger and more diverse samples, adopt a pre-test–post-test or quasi-experimental design to more directly evidence data-literacy gains, and expand the scope of subjects and teaching materials so that the results of *Web Diffit* development are more comprehensive and applicable.

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