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Developing Google Sites and Mathigon Learning Media to Support Students' Conceptual Understanding in Solving Linear Equations in One Variable

Dhea Puspita Putri Agustin[1], Maria Suci Apriani[1], and Melania Liliastri[2]

[1]Sanata Dharma University, Indonesia
[2]SMPN 4 Langke Rembong, Nusa Tenggara Timur, Indonesia

Correspondence should be addressed to M.S. Apriani: mariasuciapriani2410@gmail.com

Abstract

This research notes that there is still a lack of focus on implementing digital-based learning media to helo students in understanding of the concept of Linear Equations with One Variable and in finding the solution in one of the East Nusa Tenggara (NTT) State Middle Schools. Virtual balance models can be used to help students learn the concept of linear equations. Therefore, this study aims to develop digital-based learning media, considering the quality criteria of being valid, practical, and effective. The research adopts the Research and Development (R&D) methodology with the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The research subjects are six seventh-grade students from one of the State Junior High Schools in East Nusa Tenggara with high, moderate, and low cognitive abilities. Data on the quality of learning media are obtained through questionnaires, interviews, and learning outcome tests. The learning media is categorized as highly valid with a percentage of 88% and highly practical with a percentage of 94%. Additionally, the learning media is deemed effective, with over 80% of the research subjects scoring above the Minimum Completion Criteria (KKM). Digital-based learning media utilizing the balance model feature in Mathigon with the help of Google Sites, was developed to facilitate students' understanding of concepts at one of the State Middle Schools in NTT. The problems presented in the media carry the culture that exists in the NTT region. Thus, students can easily imagine these problems because they are close to their lives. Both teachers and students feel assisted by the developed learning media. Using this media, teachers enable to monitor the students' progress and students also can participate actively during this learning.

Keywords: balancing model; conceptual understanding; development; linear equation in one variable

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Abstrak

Penelitian ini mencatat bahwa masih kurangnya fokus pada implementasi media pembelajaran berbasis digital untuk membantu siswa dalam memahami konsep Persamaan Linear Satu Variabel (PLSV) dan penyelesaiannya di salah satu SMP Negeri Nusa Tenggara Timur (NTT). Model keseimbangan virtual dapat dimanfaatkan untuk membantu siswa dalam mempelajari konsep persamaan linear. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan media pembelajaran berbasis digital pada materi persamaan linear satu variabel dengan memperhatkan kualitas yaitu valid, praktis dan efektif. Penelitian ini menggunakan jenis penelitian dan pengembangan atau Research and Development (R&D) dengan model ADDIE (Analyze, Design, Development, Implementation, Evaluation). Subjek penelitian adalah enam peserta didik kelas VII di salah satu SMP Negeri Nusa Tenggara Timur dengan kemampuan kognitif tinggi, sedang dan rendah. Data kualitas media pembelajaran diperoleh dari kuesioner, wawancara dan tes hasil belajar. Media pembelajaran dikategorikan sangat valid dengan persentase 88% dan sangat praktis dengan persentase 94%. Serta media pembelajaran juga dikatakan efektif, lebih dari 80% subjek penelitian mendapatkan nilai diatas Kriteria Ketuntasan Minimal (KKM). Media pembelajaran berbasis digital dengan memanfaatkan fitur model keseimbangan pada Mathigon berbantu Google Sites, dikembangkan untuk memfasilitasi pemahaman konsep siswa di salah satu SMP Negeri di NTT. Permasalahan yang disajikan dalam media tersebut, mengusung budaya yang ada pada daerah NTT. Sehingga siswa dapat dengan mudah membayangkan permasalahan tersebut karena dekat dengan kehidupan mereka. Guru dan peserta didik merasa terbantu dengan media pembelajaran yang telah dikembangkan. Guru dapat memonitoring perkembangan siswa dan siswa melalui media ini dapat terlibat aktif dalam pembelajaran.

INTRODUCTION

In science education, conceptual understanding is to be the primary goal (Konicek-Moran & Keeley, 2015). Especially in mathematics, Syam (2019) said that conceptual understanding is one of ability that must be mastered by students in learning mathematics. With a good grasp of the fundamental concepts, students can solve problems effectively (Fajar et al., 2018). Why? Because conceptual understanding is the comprehension of why you do it, not only what to do it (Cummings, 2015). Therefore, by understanding the concept, students are expected to connect and apply it in their daily life (Syam, 2019).

One of concept in mathematics that is important to solve the daily problems is algebra (Nafii, 2017). Algebra is one of branch in mathematics that be the major component of the mathematics curriculum in most of countries (Bal, 2016). The unknowns, arithmetical operations, variables, expressions, and equations are some concepts of algebra (Mengistie, 2020). In junior high school, students learn about how to express the real problem into algebraic form using variables and solve the algebraic equation, especially linear equation. Mengistie (2020) said that linear equation be the important topics in algebra and has important role in other mathematics concepts.

In fact, most of students have lack in understanding the concept of linear equation. They have problem in seeing the equal sign. Students view the equal sign as symbol that indicate the answer (Knuth et al., 2006;Tan et al., 2013). For example, when solving the problem 4 + 8 = 5 + __, the students put the adding numbers of 8 and 4 in the blank (Falkner et al., 1999).

The fact of lacking understanding of linear equation concept also found at a public junior high school in the province of East Nusa Tenggara (NTT). During an interview with a mathematics teacher who has three years of teaching experience, the teacher mentioned that there are issues regarding the solving of linear equations with one variable in the seventh-grade curriculum, particularly in the operations of addition and subtraction. The problem arises from the students' incomplete understanding of the concept. The students are not aware of the correct fundamental concept of "moving terms."

They mistakenly assume that when terms are moved, pass the equal sign, the mathematical operation will be reversed or in other word "change sides, change sign". The students do not understand that the changing of the operation because of the inverse operation to preserve the equality of equation.

Balance model is one of strategy that most used by teachers to teach the concept of linear equation. Otten et al., (2019) found that from 29 articles were selected in which the balance model was used to teach linear equation solving, the using of balancing model has positive effects on students' understanding in linear equation solving. The use of balance model is suitable for the concept of linear equation because 1) related to the equality concept: both sides of a balance model represent equal value and can be exchanged, this is very suitable for representing the concept of equality, 2) related to the physical experience: maintaining balance as a biological activity can be connected to the abstract idea of maintaining equality in an equation, 3) related to learning through models and representations: balance model can provide an opportunity to semantically and syntactically set a foundation for linear equation solving. Based on 29 articles, only 2 articles that using virtual balance model. While others use physically balance model or drawn balance model.

To teach a concept effectively, teacher can integrate the learning process using technology as a media. But in fact, at a public junior high school in NTT, they have not yet used digital technology-based learning media to enhance the development of teaching materials. According to Jamun (2018), the use of technology has a positive impact on the field of education. When utilized properly, digital technology in education can enhance students' interest, motivation, the quality of the learning process, and understanding (Hidayat & Khotimah, 2019). Mathigon is one of learning media that can facilitate the understanding of the concept of solving linear equations with one variable. It provides balance model feature that can be accessed by student interactively. As stated on their website, Mathigon - The Mathematical Playground, Mathigon is a website that resembles a mathematical playground to make online learning more engaging and interactive, created using free features. Mathigon offers several features including Polypad, courses, activities, and lessons. Among these features, there are various topics such as geometry, fractions, algebra, and probability. In the algebra section of the Polypad feature, there are illustrations related to balancing scales. Mathigon's Polypad feature can be used to visualize abstract concepts in mathematics. According to Prasetya (2021), Mathigon can be utilized to create digital teaching materials in the form of interactive activities.

To support students' understanding, the learning material must be presented sequentially so that student has a complete comprehension. Therefore, Mathigon must be integrated using other learning media because Mathigon doesn't have features to present it. There are various digital-based learning media available, including e-books, websites, e-modules, flash, and others (Sitepu, 2022). The chosen learning media for this study is a website because it can contain images, links (videos or other required resources), interactive PowerPoint. A website-based learning media is practical and can be accessed anywhere with an internet connection (Aditya, 2018). In line with this, according to Setyadi & Qohar (2017), in their research, they stated that a website-based learning media allows students to actively engage in the learning process. One of the platforms used for creating

websites is Google Sites. According to Pubian & Herpratiwi (2022), Google Sites can be used as a learning media in 21st-century classrooms and the technological industrial revolution. Google Sites is one of the products in Google Docs that is used for creating websites for free.

From the elaboration above, the combination of Google Sites and Mathigon as learning media can assist seventh-grade students in understanding the material of solving linear equations with one variable, especially in the operations of addition and subtraction. This research develops learning media using Google Sites to organize the material effectively. This is in line with the research conducted by Maskar et al., (2021), where the use of Google Sites can help the learning process in creating online notes. The learning media is also combined with Mathigon to make the learning process more interactive. Therefore, the objective of this research is to develop Google Sites as a learning media with the assistance of Mathigon to help seventh-grade students in solving linear equations with one variable using the correct concepts.

METHOD

This research aims to develop learning media based on the needs of the subjects and learning resources to solve the problem about conceptual understanding in solving linear equation in one variable. Therefor, this research utilizes the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation). Because ADDIE development model is a systematically designed model to solve learning problems related to learning resources and learner characteristics (Tegeh et al., 2014). Typically, this research model is used to develop products such as textbooks, learning modules, multimedia learning materials, and similar materials.

In the analyze phase, a needs analysis regarding what material that still make student confused, what competency that need to be improved, learning environments that are support, and learning media is needed, need to be analyzed. Therefor, at this phase the output produced are profile or characteristics of subjects, identification of needs, and detailed task analysis of learning environments and learning media. The second phase is design. At this phase, a work plan was made by making design principle and story board. While at the third stage, that is development, design that was made at the second stage is realized into the media (Google sites and Mathigon). The media that was made be implemented to the students. This is the results of the fourth phase. For the last phase, evaluation is conducted by giving questionnaire to students and teacher to get the feedback of the implementation of the media in school.

The quantitative data obtained from this research includes the scores obtained from closed-ended questions in the questionnaire to measure validity and practicality, as well as the scores from the learning outcome test. The questionnaire data is measured using a Likert scale. After calculating the average percentage of feasibility and the obtained results in decimal numbers, rounding will be applied. As for the categorization, it is adapted from (Handayani et al., 2021) as shown in Table 1.

Table 1. Criteria for validity and practicality

Percentage	Criteria
$85\% < x \leq 100\%$	Very valid/very practical
$70\% < x \leq 85\%$	Sufficiently valid/sufficiently practical
$50\% < x \leq 70\%$	Less valid/less practical
$0\% < x \leq 50\%$	Not valid/not practical

As for the learning outcome test, a scoring guideline is needed as shown in Table 2.

Table 2. Scoring Guidelines for Learning Outcome Tests

No.	Indicator	Description	Score
1.	- Presenting concepts in various mathematical representations - Classifying objects according to their specific properties based on the concept	Unable to answer (blank response)	0
		Wrong answer and incorrect reasoning	1
		Correct answer but incorrect reasoning	2
		Correct answer and correct reasoning	3
2.	- Restating a concept - Selecting, using, and applying a specific procedure or operation	Unable to answer (blank response)	0
		Wrong answer and incorrect reasoning	1
		Correct answer but incorrect reasoning	2
		Correct answer and correct reasoning	3
3.	Determining examples and non-examples of a concept	Unable to answer (blank response)	0
		Wrong answer and incorrect reasoning	1
		Correct answer but incorrect reasoning	2
		Correct answer and correct reasoning	3
4.	- Applying concepts in problem-solving - Selecting, using, and applying a specific procedure or operation - Applying problem-solving concepts or algorithms	Unable to answer (blank response)	0
		Able to write in mathematical form but incorrect solution	1
		Correct mathematical form and solution but without a conclusion	2
		Correct mathematical form, solution, and conclusion	3

RESULTS AND DISCUSSION

Developing Learning Media

Analyze

Adapted from Sugiyono (2013), the analysis phase includes the analysis of the material, competency analysis, learning environment analysis, and analysis of learning media needs. The detailed results of the analysis are as follows: Through interviews with a teacher at a public junior high school in East Nusa Tenggara, it was found that the students do not understand the basic concept of solving linear equations with one variable. They have been solving equations by moving terms without understanding the basic concept behind it. The teacher mentioned that one of the reasons the students do not grasp the concept is because the language used in the reference book is very advanced and difficult to comprehend. Additionally, the teacher has never used learning media, while according to Novitasari (2016), learning media can assist in the students' concept comprehension.

The school environment is supportive, with features such as Wi-Fi and a projector screen. The students tend to be passive, and so far, the teacher has only used lecture-based teaching methods.

Since the school is still using the 2013 curriculum, the relevant competencies encompassing the material are Competency Standard 3.6, which involves explaining linear equations and inequalities with one variable and their solutions, and Competency Standard 4.6, which involves solving problems related to linear equations and inequalities with one variable. This study focuses on the precise concept of moving terms in addition and subtraction operations because by using the correct steps and solution rules, students can think systematically and accurately as well (Patricia & Laja, 2020).

Design

Based on the analysis of the material, the topic used is solving linear equations with one variable, specifically focusing on addition and subtraction operations. Real-life problems are used as the context for the learning material because. According to Sulastri (2016), Learning that is closely related to students' daily lives can facilitate their understanding of concepts. The required learning media is a medium that

can combine several structured and well-organized real-life problems. A website that created by Google Sites is a suitable learning medium that can combine the created problems, guide students in a structured and easy to use (Jubaidah & Zulkarnain, 2020). There are several features that help make the learning media more structured and have a clear flow, including pages and embeds.

Mathematics becomes meaningful and engaging when learning involves interaction with learning media that visualize basic mathematical concepts. One website that resembles a mathematical playground is Mathigon. Mathigon is chosen because, according to Istiqomah in(Prasetya, 2021), it is an interactive learning media that can be utilized to visualize abstract concepts. One of the tools available in Mathigon that aligns well with the topic is the balance scale in the Polypad feature. This feature is highly relevant to the concept of solving linear equations with one variable. Research conducted by (Wahyuni, 2019) shows that the concept of linear equations with one variable can be visualized using the concept of a balance scale. Therefore, this learning media will utilize the balance scale feature in Mathigon to teach the solution of linear equations with one variable.

This study will develop a website-based learning media using Google Sites with the assistance of Mathigon. The selected problems will be closely related to the students. Additionally, design principles are needed to ensure that the learning media can achieve its learning objectives. The design principles can be seen in Table 3.

The next activity is to create a storyboard that will be incorporated into the learning media. The storyboard provides an overview of problems that are familiar to the students. The objects used in these problems are local traditional foods, specifically rebok. There will be two problems included in the learning media. The storyboard can be found in Table 4 (See Appendix A).

Table 3. Design principle

Media Principle	Supporting Principles
Learning media needs to provide interactive activities to: • Assist students in restating concepts. • Help studentsarticulate the solution process in mathematical form. • Assist students in selecting, using, and applying specific procedures or operations. This is supported by research conducted by Novitasari (2016) which states that interactive multimedia can enhance students' mathematical abilities, encompassing the three indicators mentioned above.	• By using Mathigon's Polypad feature, students are asked to move objects to keep the balance on the scale. • By using Mathigon and tables to assist students in writing the solution process systematically.
Learning media needs to provide contextual problems so that: • Students can determine the unknown objects/elements (variables) in the given problem and the known objects/elements (constants) with their known values. • Students can identify examples and non-examples of a concept. • Students can apply the concept to problem-solving. This is supported by research conducted by Sulastri (2016), which suggests that the implementation of a contextual approach in mathematics instruction can improve students' mathematical abilities, covering the three indicators mentioned above.	• Using examples of objects around them, "kompiang", a traditional Manggarai food. • Using contextual problem examples supported by practice exercises on the website.

Development

The next stage is the creation of a prototype, which involves arranging the previously created visualizations and adding dialogues. The prototype results can be seen in Figure 1 and Figure 2.

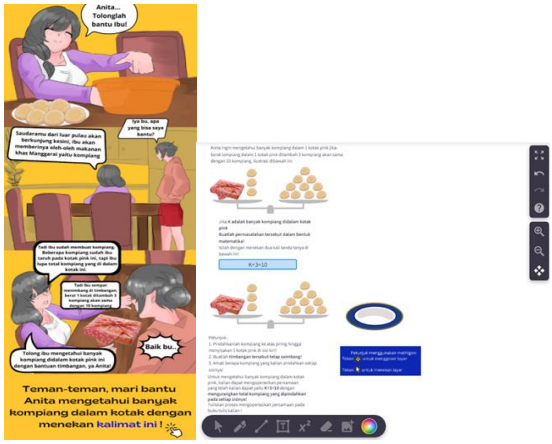

Figure 1. Prototype of Problem 1

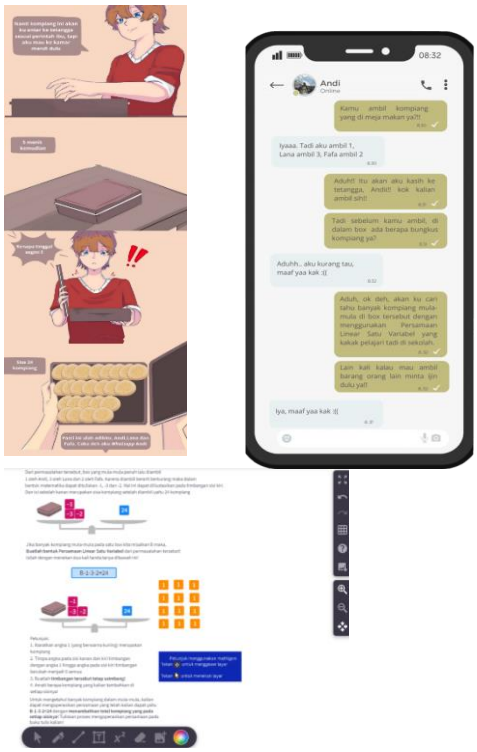

Figure 2. Prototype of Problem 2

Next, create supporting activities such as a preface aimed at recalling previously learned material, followed by a conclusion that includes drawing conclusions and asking questions to ensure understanding among the students. Once all the components are ready, they can be combined in Google Sites using the "Insert Images" and "Embed" features, linking relevant images. The combined display of the components on Google Sites can be seen in Figure 3.

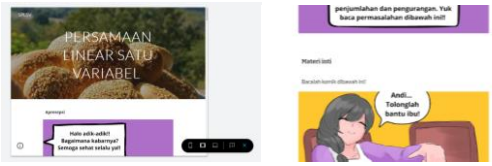

Figure 3. The appearance of Google Sites before the revision.

The next step is validation by experts. The validators in this study are one of the education lecturers from Sanata Dharma University and a mathematics teacher junior high school in East Nusa Tenggara. The results show that the learning media is valid with a percentage of 88.3%, which falls under the category of highly valid.

Revision was made for the first problem. The sentence "*berat 1 kotak ditambah 3 kompiang akan sama dengan 10 kompiang*" (weight of one box plus three kompiang is equal to ten kompiang) was deemed inappropriate and conveyed a meaning that is not consistent with the concept being taught, according to the validator. Therefore, the sentence was modified to "*berat kompiang dalam satu kotak ditambah tiga kompiang akan sama dengan 10 kompiang*" (the weight of kompiang in one box plus three kompiang is equal to ten kompiang). Additionally, the content expert suggested the inclusion of assumptions in the concept. The revision was made accordingly, as shown in Figure 4.

Figure 4. Revision for Problem 1

The validator also provided feedback and suggestions to allow space for participants to write down the process they have done. Therefore, additional space is provided for them to fill in, as shown in figure 5.

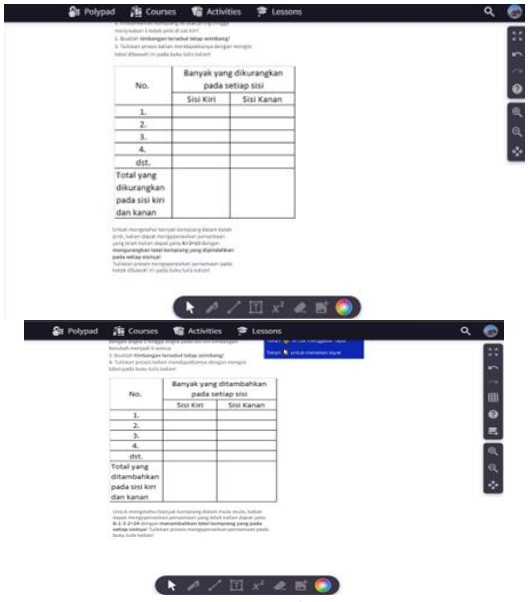

Figure 5. Revision for Mathigon

The validator suggested adding a sub-chapter before the main content by maximizing the features available on Google Sites. The "Pages" feature is used to create a more structured presentation and implement the media expert's advice to maximize the features on Google Sites.

The revised version of Google Sites can be seen in Figure 6.

Figure 6. Revision for Google Sites Layout

Implementation

The implementation phase took place on November 19, 2022. The implementation was conducted offline for 3 hours of class or 120 minutes, and it was observed online through a Zoom meeting. During this phase, the quality of the learning learning media was assessed and found to be practical. The practicality was determined based on the questionnaires filled out by the teachers and research subjects. Following that, on November 26, 2022, a learning outcome test was administered consisting of 4 questions and completed individually and in a closed setting. According to Rapono et al., (2019), the learning outcome test can measure the students' abilities, and it was found that 80% of the research subjects achieved scores above the minimum passing grade.

Evaluation

From the implementation results, questionnaires were distributed to the research subjects and teachers. The findings revealed that the teachers felt supported by the learning media that was created. They also believed that the learning media helped the students in understanding the basic concepts of solving linear equations with one variable, particularly addition and subtraction operations. The research subjects also mentioned that using this learning media helped them better

comprehend how to solve linear equations with one variable and gain a deeper understanding of coefficients and variables. One of the advantages of this learning media was its use of objects that were familiar to the students, such as NTT's traditional food, "kompiang," which added contextual relevance to the problem-solving scenarios. This provided an advantage for the students as they could easily comprehend and relate the learning materials to something familiar and relevant in their daily lives.

In conclusion, both teachers and students found the Google Sites learning media with the assistance of Mathigon to be beneficial. Since the students were using Google Sites and Mathigon for the first time, they faced some difficulties in operating the tools, particularly Mathigon. However, these challenges could be overcome with the guidance and support of the teachers.

The Quality of Learning Media

Validity

According to Walker & Hess (1984), the criteria for validity in instructional media include content and objective quality, instructional quality, and technical quality. In the study conducted by Panjaitan et al., (2020), the validation sheet was divided into two parts: a media validation sheet that covers the general technical aspects of instructional media, and a content validation sheet that covers instructional and content aspects. Therefore, in this study, two validation sheets were used: a media validation sheet that assesses the technical quality of instructional media, and a content validation sheet that assesses the content quality, objectives, and instructional quality. The instructional media validator consisted of a mathematics education lecturer from Sanata Dharma University and a mathematics teacher from a public junior high school in East Nusa Tenggara. Media and content experts completed a questionnaire consisting of 29 closed-ended questions and 8 open-ended questions. The results of the validation questionnaire can be seen in Table 5.

Table 5. The results of the validation questionnaire

Criteria	Indicator	Val. 1	Val. 2
Content quality and objectives	Relevance of content to the Basic Competence (KD)	6	8
	Conceptual accuracy	3	4
	Sequence of presenting material	6	8
	Appropriateness of provided examples	9	12
	Appropriateness of language for student thinking level	3	4
	Language fluency	3	4
	Terminology accuracy	3	4
	Grammar and spelling accuracy	3	4
Learning quality	Learning objectives	7	8
	Conceptual understanding	3	4
	Summarization	3	4
	Provision of exercises	6	8
	Appropriateness of illustrations to clarify the material	4	4
Technical Quality	Font	9	12
	Spacing usage	3	4
	Illustrations	6	8
	Navigation buttons	3	4
	Background color	3	4
	Ease of use	6	8
	Total	89	116
	Score percentage	76,7%	100%
	Overall percentage	88,3%	

Val 1 and Val 2 refers to Validator Score for responden 1 and 2.

With an overall percentage of 88.3% and based on the categorization, the instructional media can be classified as highly valid as it meets the minimum threshold for high validity. Both validators also stated that the instructional media can facilitate students' understanding of the concept in solving one-variable linear equations. Regarding the content aspect, the validator provided some suggestions, stating that the concept needs to be adjusted by modifying less appropriate sentences and providing assumptions. These details have been explained further in the development section.

According to the validator, the strengths of the instructional media include using problems that are relatable to students, engaging illustrations and stories, interactive features, and providing detailed explanations of solution steps using language that is easily understood by students. However, the validator mentioned a limitation of the instructional media, which is the underutilization of features in Google Sites. It would be beneficial to provide structured pages or subtopics for better organization.

Practice

According to Akker et al., (1999), stated that the level of practicality can be observed from the responses of teachers and students in using instructional media, whether they consider the media to be easy and usable. To measure practicality, a questionnaire was used as a research instrument. The results of the questionnaire can be found in Table 6 and Table 7.

Table 6. Results of Students's Practicality Questionnaire

Aspect	Indicator	Score
Ease	Easy to carry around	22
	User interface is easy to understand	17
	Practical to use	18
	Clarity of written statements	23
	Clarity of text on the media	22
	Provides a place to provide feedback on technical operation	23
	Illustrations are easily understood	21
	Overcomes technical constraints and provides a place to provide feedback on technical operation	22
Usefulness	The learning media can help improve student understanding	22
	Practicality Percentage	**87,9%**

Table 7. Effectiveness Questionnaire's Results

Aspect	Indicator	Score
Ease	Easy to carry around	4
	User interface is easy to understand	4
	Practical to use	4
	Clarity of written statements	4
	Clarity of text on the media	4
	Provides a place to provide feedback on technical operation	4
	Illustrations are easily understood	4
	Overcomes technical constraints and provides a place to provide feedback on technical operation	4
Usefulness	The learning media can help improve student understanding	4
	The learning media can help teach specific topics	4
	Practicality Percentage	**100%**

Based on the results of both practicality questionnaires, from both students and teachers, the instructional media is considered very practical. The overall percentage is 94%, which meets the minimum criteria for being highly valid. According to Putra (2021), instructional media is considered practical if it fulfills two aspects: ease of use and usefulness. This is consistent with the statements provided by students and teachers, who expressed that they felt assisted in understanding and teaching with the instructional media. They also mentioned that the instructional media was easy to use overall. There were some challenges in operating Mathigon, but they could be overcome with the guidance of the teacher.

Effective

According to Akker et al., (2010), effectiveness refers to the extent to which a product achieves its intended goals. Instructional media is considered effective if it helps students find the correct solutions to one-variable linear equations with the appropriate concepts. This can be observed through the test scores of the students. If 80% of the research subjects achieve scores above the Minimum Mastery Criteria, which is 75, then the instructional media can be considered effective. The results of the learning outcome tests can be seen in Table 8.

Table 8. Test Results of Learning Outcomes

Indicator of Conceptual Understanding to be Achieved	Test Format	Average score
- Restating a concept - Selecting, using, and applying a specific procedure or operation	Essay	2,5
- Restating a concept - Selecting, using, and applying a specific procedure or operation	Essay	3
- Presenting concepts in various mathematical representations - Classifying objects according to specific properties based on the concept	Multiple choice	3
- Determining examples and non-examples of a concept	Essay	1
- Applying concepts in problem-solving - Selecting, using, and applying a specific procedure or operation	Essay	3

Table 9. Percentage of learning outcomes test

	Number of students above the minimum passing grade	Number of students below the minimum passing grade
Number of students	5	1
Percentage	83,3%	16,7%

Since more than 80% of the research subjects obtained scores above the average, the instructional media can be considered effective in assisting students in finding solutions to one-variable linear equations with the correct concept. Therefore, it can be concluded that the Google Sites instructional media with the assistance of Mathigon is effective in facilitating concept understanding.

Discussion

The implementation of the media was carried out for 120 minutes. During the implementation, the researcher observed that the students were enthusiastic about using instructional media. After conducting interviews with the students, it was found that they all remembered the instructional media used and found it easier to understand the concept of finding the solution of one-variable linear equation. This is supported by Aditya (2018) who stated that the website instructional media helped students understand a concept.

One of fiture in Mathigon that support students easier in understanding the concept in finding the solution of single-variable linear equation is tools balance scale polypad. Balance model is an innovative tool that makes algebra easier for students to learn and it is also a powerfull tool that can make students more understand about the equations' idea (Waaren & Cooper, 2005). The findings of Otten et al., (2019) strengthen the previous statement, that is balance model very suitable for demonstrating the concept of equality because both sides of a balance model represent equal value and can be exchanged. Besides it, balance model can provide an opportunity to semantically and syntactically set a foundation for linear equation solving. It is in line with the findings of Atteh et al., (2017) that one of advantage of the balance model in teaching linear equation is promoting the view of an equation as an object. Study that conducted by Mengistie (2020) show that balanced model teaching method is an effective means of developing students' understanding of a relational view of the equal sign and its ability to operate equality. Most students use more flexible strategies after do the activities using balancing model.

Table 8 shows that the implementation of the media using balance model in Mathigon integrated Google Site can help students in understanding the concept of equally and in finding the solution of linear equation. It is in line with the results as of the study of Otten et al., (2019). However, this study shows that balance model using Mathigon integrated Google Site not enough to facilitate students' ability in determining the example and non-example of one-variable linear equation. The representation of variables in Mathigon is

limited and not enough representative. If we want to use the representative icon, we must download the icon first. Whereas the icon of variables that available in Mathigon is limited. Therefore, although virtual balance models can be used in teaching the concept of finding the solution of one-variable linear equation, but it is not sufficient to facilitate the representative of variables which resulted it is hard to make the suitable representative of variable in one-variable linear equation.

Through interviews, teachers also felt assisted by the instructional media and found it easier to visualize a concept. Teachers also mentioned that the use of instructional media made students more interested in learning mathematics. This finding is in line with (Lestari, 2018), that is using technology in learning, can give impact in learning. Such as, increase stundents' learning interest, so that it can make learning process more effective. However, there are limitations; due to device constraints and lack of knowledge about digital instructional media, teachers cannot frequently use this digital-based instructional media.

Implications of Research

The results of this study are expected to provide information to teachers regarding website instructional media and Mathigon as alternative learning tools. The research subjects reported that they found assistance from this learning media, and quantitatively, it has been proven that the learning media is valid, practical, and effective. Furthermore, it is recommended to implement them in higher-level subjects or grade levels. It would also be beneficial if students are allowed to create accounts and log in during Mathigon usage, as this would enable teachers to monitor the students' progress.

Limitation

The limitations of this study include: 1) The instructional media developed is still in the preliminary stage and only covers a subtopic of one-variable linear equations, specifically addition and subtraction operations; 2) Due to time, cost, and resource constraints, the researcher monitored the implementation of the instructional media through online platforms such as Zoom meetings; 3) The students did not have Google accounts, which prevented them from signing up for Mathigon.

CONCLUSION

The instructional media, Google Sites and Mathigon, developed using the ADDIE research and development model, can facilitate students' understanding the concept of equally and in finding the solution of linear equation with one variable, specifically focusing on addition and subtraction operations. The quality of the instructional media is evaluated based on three aspects: validity, practicality, and effectiveness. The instructional media is classified as highly valid with an 88% percentage and highly practical with a 94% percentage. Additionally, the instructional media is deemed effective to increase the students' understanding of equal sign and in solving linear equation, as more than 80% of the research subjects achieved scores above the minimum passing grade. However, not sufficient effective in increase the students' understanding of variable.

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Appendix A of article entitled Developing Google Sites and Mathigon Learning Media to Support Students' Conceptual Understanding in Solving Linear Equations in One Variable

Table 4. Storyboard

Scene	Visual Description
Problem 1	
There is a mother who is cooking, and a child named Anita playing on the terrace. Anita is called by her mother. Mother: "Anita... Please help me!"	Mother cooking
Anita: "Yes, Mom? How can I help?" Mother: "Your relative from another island will visit us, and I will give him a special food gift from Manggarai, which is kompiang."	Child approaches the mother
Mother: "I have prepared the rebok and put them in a box, but I forgot how many rebok are in the box. Earlier, I weighed one box plus 3 kompiang, and it was equal to 10 kompiang. Please help me determine the number of kompiang in the box!" Enter Mathigon	Conversations between the mother and child with a pink box on the table containing kompiang
There is a scale with one box plus 3 kompiang on the left side and 10 kompiang on the right side. The scale is balanced. There is a plate next to the scale. The student is asked to move the kompiang from the scale to the plate, leaving only one box on the left side and keeping the scale balanced. The student is also asked to write the process in a table and represent it in the form of a linear equation. Through this activity, the student is expected to find the solution to the linear equation in mathematical form.	The scale represents the problem with one box and 3 kompiang on the left side and 10 kompiang on the right side. The scale is balanced.
Problem 2	
There is a child who is asked by their mother to deliver kompiang to their neighbor. But before that, the child goes to the bathroom first. Anton: "I will deliver these kompiang to the neighbor as instructed by Mom, but I need to go to the bathroom first"	A child places a box containing kompiang
5 minutes later	A picture of a closed box on the table
Anton: "Why is it only this much left?!" There is an empty part and only 24 kompiang left Anton: "It must have been the actions of my younger siblings, Andi, Lana, and Fafa. Let me message Andi."	An image of the box of kompiang open, but with reduced contents
Anton: "You took the kompiang from the dining table, right?!" Andi: "Yes, I took 1, Lana took 3, and Fafa took 2." Anton: "Oh no!! Those were supposed to be given to the neighbor, Andii!! Why did you take them?!" Anton: "Before you took them, how many kompiang were in the box?" Andi: "Oh.. I don't know, sorry)):" Anton: "Oh, okay, I will figure out how many kompiang were originally in the box using the Linear Equation with One Variable that I learned at school" Anton: "Next time, if you want to take someone else's belongings, ask for permission first, okay?!" Andi: "Yes, sorry)):" Enter Mathigon	WhatsApp chat
There is a scale with a box and number cards (available on tiles) on the left side, which are labeled -3, -2, and -1. On the right side of the scale, there is a number card with the value 24. The student is asked to solve the problem by overlapping the number cards on the scale with other number cards representing kompiang. The student is required to change the number cards on the scale to make it equal to 0, leaving only the box on the left side of the scale while keeping it balanced. The student should write the process on the table and find the solution in mathematical form.	The scale represents the problem with one box and number cards labeled -3, -2, and -1 on the left side, and a number card with a weight of 24 on the right side. The scale is balanced.