"In-Math" as a Website-Based e-Learning Media in the Endemic Era

Tri Murdiyanto*, Dwi Antari Wijayanti, Nyla Farhatul Maula, and Anny Sovia

***Abstract*—This research aims to develop a website-based e-learning for social arithmetic for Grade VII of junior high school, named "In Math". This study refers to the Borg and Gall model with five stages. The first, the need for analysis for teachers and students. The second, planning and developing the initial product. The third, validation from material and language experts and media experts, and revising the product. The fourth, small group testing, while the fifth stage is large group testing on teachers and seventh grade students in a junior high school in Jakarta, Indonesia. Based on this research, the percentage of the product feasibility according to the material and language experts is 85.42%, 83.39% for media experts, 75% for the small group tested on teachers 75%, 86.67% for the evaluation of 21 students, 95.2% for the large group tested of teachers, and 86.25% for the evaluation of 41 students. The average percentage of the product feasibility at each stage reached 85.32% and is categorized as very feasible. Thus, the "In Math" website-based e-learning is feasible to use.**

***Index Terms*—Borg and gall, e-learning, in-math, media, website.**

I. Introduction

The pandemic that swept across the world has begun to transition to becoming endemic and activities are gradually returning to normal. However, it has caused drastic changes to all fields, including the world of education, such as learning in schools. Some people argue that online learning has become one of the favoured learning alternatives, and many say that they are already comfortable with the online learning process that involves technology because it is more flexible in terms of time and place, is easily accessible, and cost-effective [1]-[4]. Although world conditions have started to return to normal, learning activities will not be completely separated from technology, especially in the use of learning media.

The results of a survey conducted on students at a school in Jakarta regarding the use of learning media in mathematics subjects revealed that 36% found it helpful in understanding the material and only 6% stated that the media could motivate them to learn. The percentage shown is still relatively small; this is because the media used by the teacher is quite limited, such as PPT, videos, and modules. Teachers do not have enough time to develop varied learning media. This causes students to experience several obstacles in learning mathematics, including difficulty focusing on understanding the material because the material is thought to be boring, difficulty in understanding the concepts presented, difficulty relating the material to everyday life, and the incompatibility of the teacher's teaching style with student learning styles.

Furthermore, more than 70% of students stated that they needed an innovative learning media that helps them to understand the material more easily and encourages them to be motivated to learn mathematics. From the results of the questionnaire, it can also be concluded that the media needed by students is media that is interesting, not boring, fun, and also easy to understand. The media in question can be in the form of website-based e-learning, android-based applications, e-books, PPT, videos, and audio books. Some of them argue that any media can be used in learning as a medium without neglecting the role of the teacher.

Based on the survey results, website-based e-learning is one of the media that can be used as an innovation in the development of learning media. Ghani stated that the use of websites as learning media can increase the effectiveness of the learning process, and most students are satisfied and play a more active and critical role in developing their skills [5], [6]. In addition, a website is often used as a distance learning medium, considering the ease of use of the tools to surf the website, the affordability of accessing the website, and it can be easily designed using several online platforms [7], [8]. Website-based learning is a form of asynchronous learning, and research results [9]-[11] have suggested that students enjoy asynchronous learning. This is because students can repeat the subject matter whenever they want, and they like the flexibility of viewing asynchronous material. Asynchronous learning can contain reading material, PPT, videos, and related lesson links [12], [13]. Therefore, website-based e-learning is considered suitable for learning during the transition from pandemic to endemic, so that students are not completely surprised by the changes that occur and can readjust themselves gradually by not completely abandoning the online learning system.

Several studies on the development of website-based learning media have been carried out by previous researchers. Among them is Fatahillah's research, where he developed the web-based learning media Schoology with GeoGebra. The results of the research show that the media is effective because it can improve students' ICT literacy [14]. Furthermore, other researchers have also developed web-based learning media, with results of their research showing that the media developed was effective for improving student learning outcomes [15]. Another researcher had developed a website-based learning media using Moodle, and the results showed that the media was able to increase student motivation in learning [16]. Based on these studies, it can be concluded that the development of website-based learning media can increase the effectiveness and motivation of students in learning. Therefore, the researchers are interested in developing a website for students for the subject of mathematics.

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Based on the analysis of previous research, the researcher developed a learning media in the form of website-based e-learning for the limitations of social arithmetic, this material was selected based on a questionnaire distributed to students, where as many as 76% of students said that social arithmetic was the most difficult. Practice questions, quizzes along with their discussions were the media development innovations carried out by the researchers compared to previous research. In addition, there is also a song that contains a collection of formulas from the material of social arithmetic. Video as one of the contents in e-learning is maintained because the results of previous research indicate that the use of video is appropriate for use in distance learning.

II. Methods

The research method for this study is research and development (research and development). Product development went through several stages that were adapted to the chosen model, namely the Borg & Gall model [17] which has been simplified into five stages, as follows:

1) Preliminary stage. The first step in developing the "In Math" website-based e-learning for social arithmetic material for Grade VII is to analyze the needs of mathematics teachers and students. This activity aims to find and determine the basic problems faced by teachers and students in the process of learning mathematics in Grade VII of junior high school. A needs analysis is done at this stage, namely by interviewing teachers and the filling out of a needs analysis questionnaire by students. The questions asked during teacher interviews and questionnaires given to students had been validated by the lecturer for the validity of the instrument.
2) Development stage. Based on the information obtained in the first step, the researchers designed to develop the "In Math" website-based e-learning for social arithmetic material for Grade VII. The researchers began to design based on the existing products developed. This process aims to create a product prototype that will be developed. Everything that is compiled in this stage is validated by the lecturer to ensure that the manufacturing of the product is valid from the beginning of its development.
3) Validation stage. The product design made was validated by several experts to find out the validity of the design. This study validated the product design with two experts, the first is was with a material and language expert, and the second was a media expert. Each expert assessed and suggested revisions from the initial product design which became the design improvement material. The two experts assessed the product by using a validation instrument that has been adapted to the needs of each expert to assess the existing products according to the scope of their respective fields. The validation instrument used was first validated by the lecturer before being used during expert validation. The results of product design validation are in the form of revisions to improve the initial product design. The input from the two experts was used in the revision of 32 product designs.
4) Small group trial stage. Small-scale field trials were conducted on 21 Grade VII junior high school students representing the target population of the media created. The purpose of a small-scale field trial is to determine the feasibility and validity of the product developed from the results of the assessment by teachers and students. This stage is carried out with an assessment of the product by students and teachers through a questionnaire. The questionnaire used has gone through a validation process by the lecturer to test its validity. The results of student and teacher product trial assessments were analyzed to revise the shortcomings of the product before a large group trial is finally carried out.
5) Large group trial phase. Large group trials were conducted on 41 Grade VII junior high school students. Similar to the small-scale field trials, in this trial students gave their assessment through a questionnaire on the product being tested. The assessment aspects of the small and large group trials had used the same instrument. The questionnaire used had gone through a validation process by the lecturer for the validity of the questionnaire. The results of the student and teacher assessments from the usage trial will be analyzed to revise the shortcomings of the product so as to produce a final product. The final product is the result of research and development in the form of the "In Math" website-based e-learning that has gone through several assessment and revision processes.

The research was conducted in one of the public junior high schools in Jakarta. The data collection techniques used were interviews and questionnaires. The data obtained was from the results of the assessment of four experts, two teachers, and several students. The four experts consisted of two people who were material and language experts and two others who were media experts. Teachers and students provided assessments during product trials both in small and large groups by filling out questionnaires. The results of the data obtained were analyzed quantitatively and qualitatively so that the approach used in this study was a mixed method.

The instrument was used when collecting data from experts, teachers, and students. The aspects assessed were adjusted to their respective roles. Each assessment indicator was filled out using a Likert score with the provisions of very good (5), good (4), sufficient (3), less (2), very poor (1). The total score obtained is calculated in percent form with the following formula:

$$\frac{total\ score\ obtained}{total\ maximum\ score} \times 100\% \quad (1)$$

The result of the percentage of feasibility shows the level of media feasibility. Learning media is said to be feasible if it has a minimum value of 70%. The Eligibility criteria shown in Table I.

TABLE I: Eligibility Criteria

No.	Eligibility Percentage	Eligibility Category
1	<21%	Very unworthy
2	21-40%	Not feasible
3	41-60%	Enough
4	61-80%	Worthy
5	81-100%	Very worth it

III. Results and Discussion

A. Initial Steps of Development

The website-based e-learning product was created using Apache as a web server, MySQL as a database, and Sublime as a text editor. Website development was carried out by Dimas as a website development service. The development of this website-based e-learning begins with creating a layout design that is packaged in one storyboard. Furthermore, to achieve the completeness of website-based e-learning content in the form of learning videos, learning summaries, learning songs, practice questions, quizzes, and discussions, a special storyboard was created containing all the required material based on the indicators and basic competencies that students must master for social arithmetic. The layout design of the website display was made using the Canva website-based graphic design application which was then sent to the website builder to be developed into a website-based e-learning as designed. Meanwhile, learning videos were made using the Animaker website-based video maker application and voice-over was done using a voice recorder as a media recorder. Song summaries and lyrics were created using Canva. The songs presented were also made using a voice recorder, as done with the voice recording for the videos. Furthermore, practice questions, quizzes, and discussions were made directly on the website using Sublime as a text editor.

B. E-Learning Content

The “In Math” website-based e-learning that was developed by the researchers has several characteristics. The characteristics possessed by In Math are in the form of material, content, and users. The material chosen is social arithmetic for Grade VII as it is the material considered the most difficult by students based on the results of the needs analysis. The content presented in e-learning includes learning videos, summaries, songs, practice questions, and quizzes. For the user section, In Math was developed to be accessible by students and teachers in order to facilitate the learning process. E-learning is also managed by the admin whose role is to approve new users to enter the e-learning system, as well as add and or edit the content provided in e-learning. A learning video is a recording that aims to convey learning material so that students achieve learning [18], [19]. The use of video as a learning medium has its advantages, such as being able to attract the students' attention even though the duration is short, complex material can be easier explained with the use of video, and video recordings can be played over and over again; however it also has disadvantages such as its one-way nature that needs another form of feedback for communication, as well as requiring fast and stable internet to download it [20], [21]. Meanwhile, a summary is a technique of writing an essay in a shorter way that includes all the main ideas. The use of summaries here is to make it easier for students to remember the material with short notes. Based on research, songs can encourage listeners to imitate the lyrics in whole or in part and make it easier for students to remember mathematical formulas [22]-[24]. Thus, the researchers decided to add songs as one of the contents presented in the e-learning. The use of songs is also an innovation made in this product so that it is different from others. The comprehensiveness of e-learning also comes from the addition of practice questions and quizzes, where their use will help students to be trained to solve problems related to social arithmetic. As stated by one of the teachers during the interview process during the needs analysis, students need to practice a large number of questions in order to better understand the material. In a previous study entitled "Development of Virtual Learning-based Mathematics Teaching Materials with Gnomio" conducted by Muhammad Fahmi Apriansyah and Heni Pujiastuti in 2020, the use of Gnomio in giving quizzes which is functioned to review the previously submitted material is not equipped with a discussion of quiz questions [25]. Therefore, in In Math, e-learning quiz questions are equipped with discussions so students can have an indepth understanding of the questions done.

C. Expert Validation Process

After the initial product was developed, the In Math website-based e-learning product was given to an expert validator for validation. The expert validators involved were material and language experts as well as media experts. The results of the validation of material and language experts are presented in Table II.

TABLE II: Validation Results of Material Experts and Linguists

No	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Contents	5	92%	Very worth it
2	Presentation	7	84.28%	Very worth it
3	Language	3	80%	Worthy

Based on the validation results from the material and language experts related to the developed In Math website-based e-learning, an average percentage of 85.42% was obtained, which is categorized as "very feasible". The product was also validated by media experts with validation results as shown in Table III.

TABLE III: Media Expert Validation Results

No	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Communication	7	84.28%	Very worth it
2	Programming	4	82.5%	Very worth it

Based on the media expert validation results of the In Math website-based e-learning that was developed, the average percentage was 83.39%, which is categorized as "very feasible".

D. Trial Process

The product was declared “very feasible” by material and language experts as well as media experts, thus the product was ready to be tested in small groups of teachers and students. The results of the small group trials on teachers are shown in Table IV, while results for the students can be seen in Table V.

TABLE IV: Results of Small Group Trial on Teacher

No.	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Contents	8	80%	Worthy
2	Design	2	60%	Enough
3	Usefulness	3	80%	Worthy
4	Operation	1	80%	Worthy

TABLE V: RESULTS OF SMALL GROUP TRIAL ON STUDENT

No.	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Contents	8	87.14%	Very worth it
2	usefulness	2	88.09%	Very worth it
3	Operation	1	84.76%	Very worth it

The results of the analysis of teacher evaluation data in small group trials conclude that "In Math" is categorized as “feasible” with the average trial result of 75%. Meanwhile, the average result of small group trials on students is 86.67%, which is categorized as “very feasible”, which enables Draft 3 ready to be tested in large group trials to produce the final "In Math" website.

Products that have gone through small group trials are continued on to large group trials with the results of the teacher assessments shown on Table VI and student assessments on Table VII.

TABLE VI: RESULTS OF LARGE GROUP TRIAL ON TEACHERS

No.	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Contents	8	87.5%	Very worth it
2	Design	2	100%	Very worth it
2	Usefulness	2	93.33%	Very worth it
3	Operation	1	100%	Very worth it

TABLE VII: RESULTS OF LARGE GROUP TRIALS ON STUDENTS

No.	Aspects measured	Number of items	Aspect Percentage	Criteria
1	Contents	8	86.33%	Very worth it
2	Usefulness	2	86.58%	Very worth it
3	Operation	1	85.85%	Very worth it

Based on the results of the teacher evaluation data analysis in the large group trial, it can be concluded that "In Math" is categorized as “very feasible” with the average test result of 95.2%. Meanwhile, the average result of large group trials for students was 86.25%, which is categorized as “very feasible”, making Draft 4 the final product of the “In Math” website-based e-learning development.

With the overall average of the assessments carried out by the experts, teachers, and students, the percentage of product feasibility is 85.23%, therefore the “In Math” website-based e-learning is in the “very feasible” category.

E. Case Implementation

The following displays the In Math website-based e-learning that was developed.

1) Initial view of the website

On the initial screen when accessing the website, there is a display that briefly explains the In Math e-learning, from an introduction, the features provided, the materials developed, and an explanation of the users who can access the website. The menu bar functions as a navigation button to direct access to the section you are looking for. To enter the e-learning, the accessor must click the “Log in/Register” button in the top right menu bar. The initial view of the website menu shown in Fig. 1.

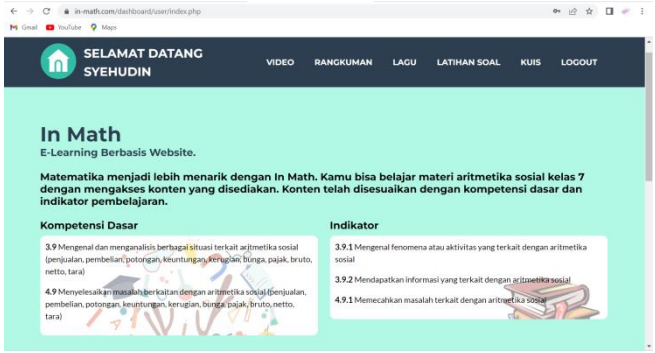

Fig. 1. Initial view of the website.

2) Login/register menu

This page serves to access the e-learning account by entering a username and password for those who already have an account. Meanwhile, those who do not can click the "Create Account" button first. The login/register menu shown in Fig. 2.

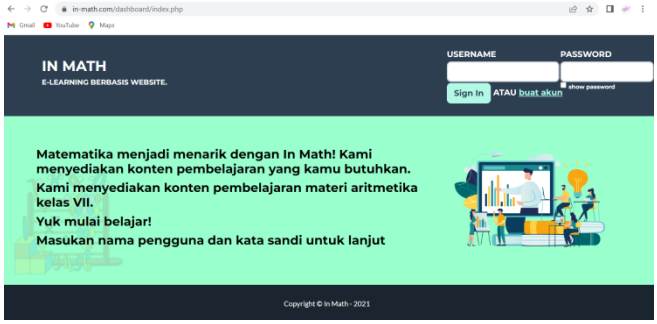

Fig. 2. Login/register menu.

3) Create account

To create a new account, users need to fill in the data on this page including name, email, username, and password. There are two types of accounts that can be created, namely student accounts and teacher accounts, which are adjusted to who the accessor is. The create account menu shown ini Fig. 3.

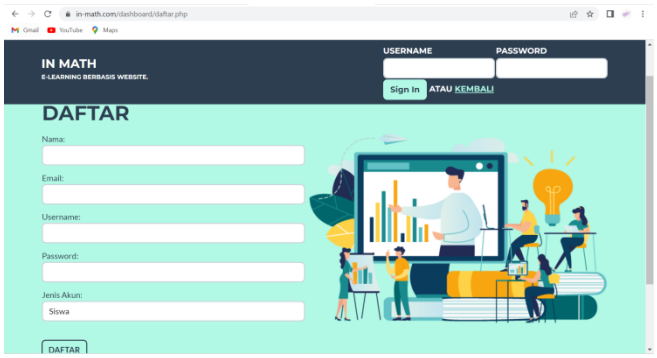

Fig. 3. Create account.

4) Main page

On the main page of this student, an explanation of the indicators and basic competencies of learning mathematics in social arithmetic for Grade VII is presented. At the bottom of the page there is a selection of content that can be accessed by clicking on each of them. The menu bar above also has the

same function, namely to access the content selected by students and also the option to log out. The main page shown in Fig. 4.

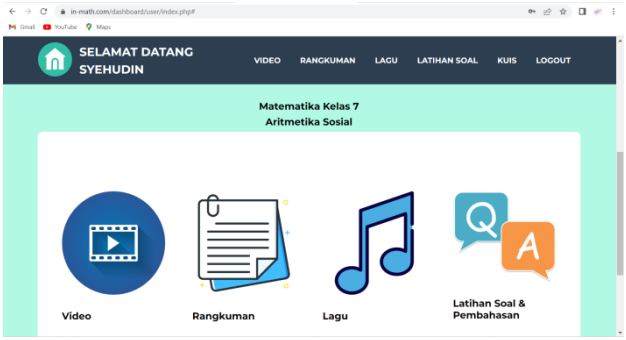

Fig. 4. Main page.

5) Student video page

Students can access the available videos from this page. Here there are five videos with different sub-discussions, namely selling price and the purchase price; profit and loss; discount; taxes and interest; and gross, net, and tare. To access each video, students only need to click on the video button that is accessed or click the "Next" button to move on to the next video. The "Menu" button directs students to the main page. The student video page shown in Fig. 5.

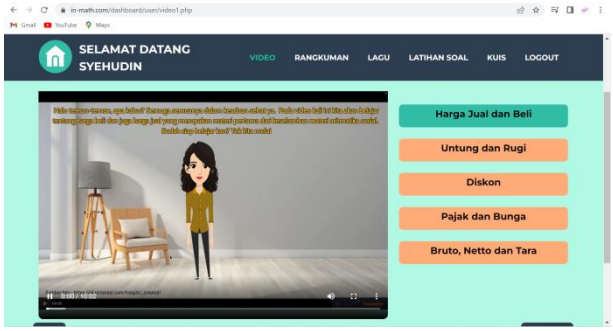

Fig. 5. Student video page.

6) Student summary page

Students can access the available summaries from this page. There are three video summaries with different sub-discussions, namely selling price, purchase price, profit and loss; discounts, taxes and interest; and gross, net, and tare. To access each student summary, you only need to click on the accessible summary button or click the "Next" button to move on to the next summary. The "Menu" button directs students to the main page. The student summary menu shown in Fig. 6.

7) Student song page

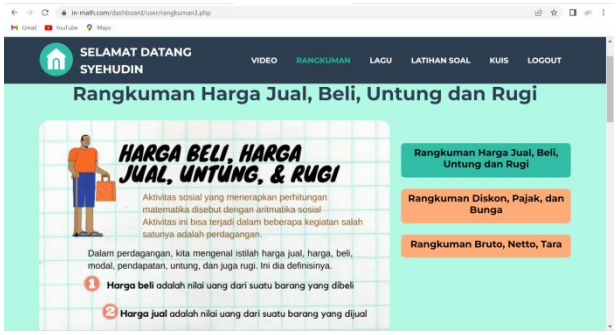

Fig. 6. Student summary page.

On this page the song and also the lyrics of the song are presented. Students can listen to the audio of the song and also read the lyrics of the song provided next to it. There are three songs with different sub-discussions, namely selling price, purchase price, profit and loss; discounts, taxes and interest; and gross, net, and tare. To access each song, you only need to click on the button of the song that is accessed or click on the "Next" button to move on to the next song. The "Menu" button directs students to the main page. The student song page shown ini Fig. 7.

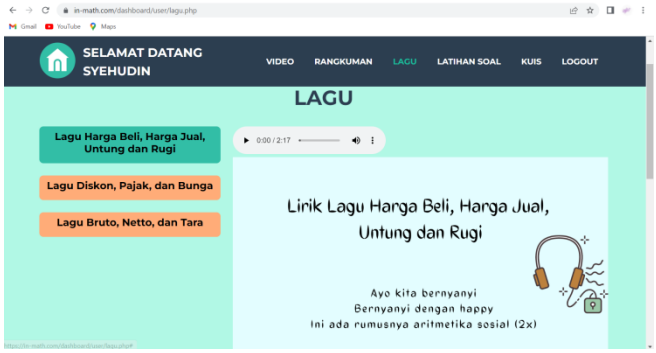

Fig. 7. Student song page.

8) Exercise page for students

On this page students can access practice questions from three different sub-discussions, namely selling price, purchase price, profit, and loss; discounts, taxes and interest; and gross, net, and tare. Each subject has a different number of questions, sequentially the number of practice questions for each sub-discussion are 10.7, and 5. There are questions and the steps how to do them so students need to answer according to the answer box provided. There is a function to find out the correct answer by clicking the "Check Answer" button, the correct answer will appear in the green box that is right next to the answer box. To access the next question that is still in the same sub-discussion, students only need to click on the "Next" button. The Exercise page for student shown in Fig. 8.

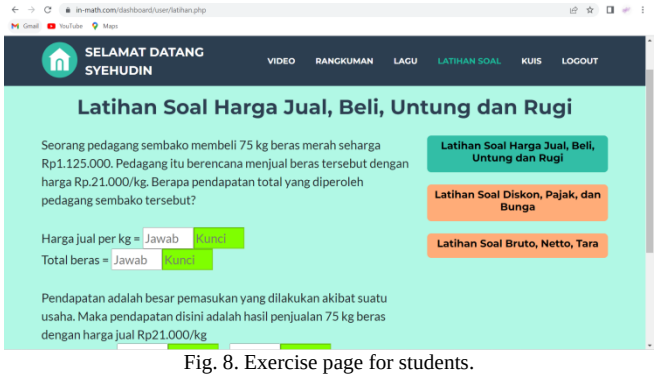

Fig. 8. Exercise page for students.

9) Student quiz selection page

This page contains a selection of quizzes based on the existing sub-discussions. The available sub-discussions are selling price, purchase price, profit and loss; discounts, taxes and interest; and gross, net, and tare. To access the quiz, students need to click on the button that displays the sub-discussion they want to choose. The student quiz selection page shown in Fig. 9.

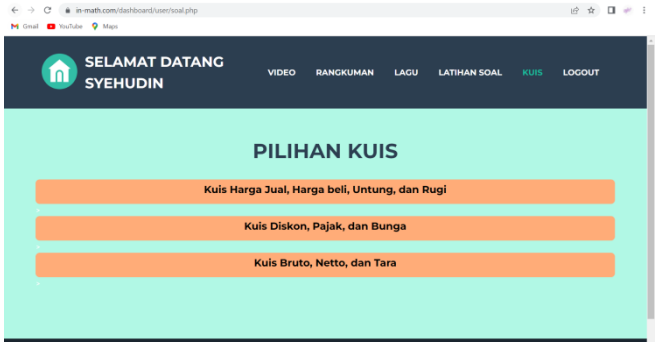

Fig. 9. Student quiz selection page.

10) Student quiz page

On this page students can access quizzes from the sub-discussions that have been previously selected on the quiz selection page. Each subject has a different number of questions, sequentially the number of practice questions for each sub-discussion is 10.7, and 5. There are multiple-choice questions and answer choices. To answer the question, students need to click on the circle next to the multiple choice answer. To access the next question which is still in the same sub-discussion, students need to first answer the previous question and click "Submit", then they will be directed to the next question display. After clicking "Submit" a pop up will appear with the correct or incorrect answers and an explanation of each question answered. The student quiz page shown in Fig. 10.

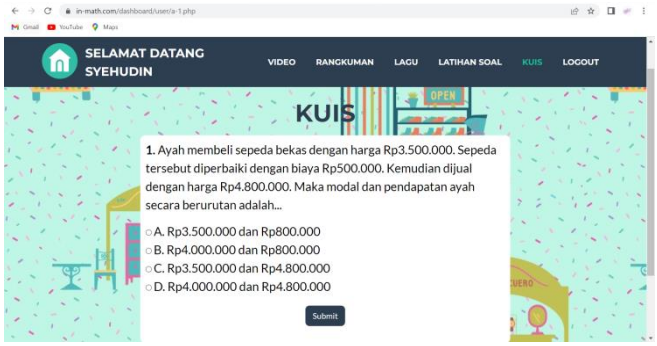

Fig. 10. Student quiz page.

11) Teacher main page

On the main page, the teacher is presented with an explanation of the indicators and basic competencies of learning mathematics for Grade VII for social arithmetic material. At the bottom of this page there is a selection of content that can also be accessed by teachers with just a click, such as a selection of videos, summaries, songs, and questions & discussions which are also accessed by the students. The menu bar above consists of access to teaching materials, a collection of questions and discussions, and the search for student grades. The option to log out is also available in the menu bar. The teacher main page presented in Fig. 11.

12) Teaching material selection page

This page contains a selection of teaching materials that can be accessed by teachers. There are three choices, namely learning videos, summaries, and songs. To access each teaching material, the teacher needs to click on the button that displays the teaching material they want to select. The teaching material selection page presented in Fig. 12.

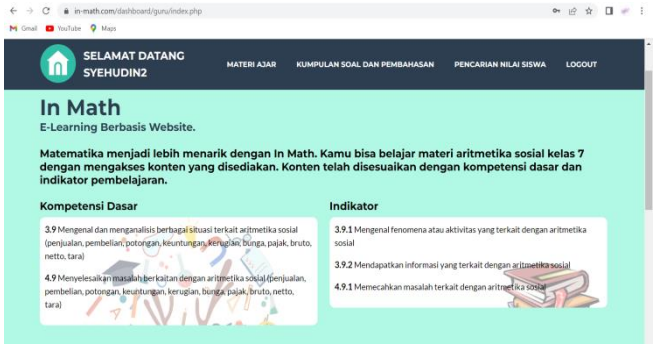

Fig. 11. Teacher main page.

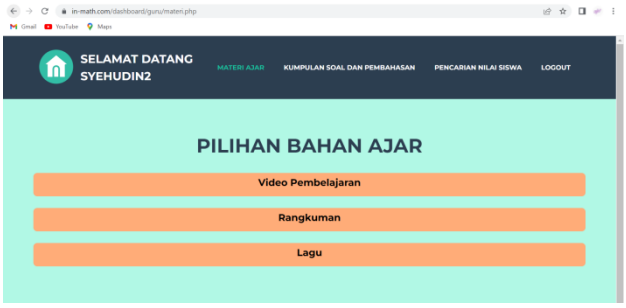

Fig. 12. Teacher main page.

13) Teacher video page

Teachers can access the available videos from this page. Here there are five videos with different sub-discussions, namely selling price and the purchase price; profit and loss; discount; taxes and interest; and gross, net, and tare. To access each video, the teacher only needs to click on the button of the video that is accessed or click the "Next" button to move on to the next video. The “Menu” button directs the teacher to the main page. The teacher video page presented in Fig. 13.

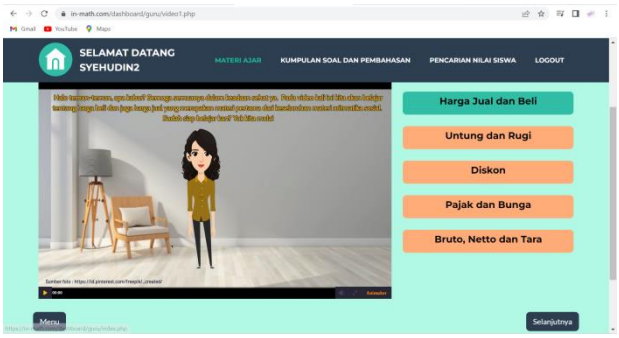

Fig. 13. Teacher video page.

14) Teacher summary page

Teachers can access the available summaries from this page. There are three video summaries with different sub-discussions, namely selling price, purchase price, profit and loss; discounts, taxes and interest; and gross, net, and tare. To access each teacher summary, you only need to click on the accessible summary button or click the “Next” button to move on to the next summary. The “Menu” button directs the teacher to the main page. The teacher summary page presented in Fig. 14.

15) Teacher page song

On this page we can find the song and also the lyrics of the song. The teacher can listen to the audio of the song and also read the lyrics of the song provided next to it. The teacher

page song presented in Fig. 15.

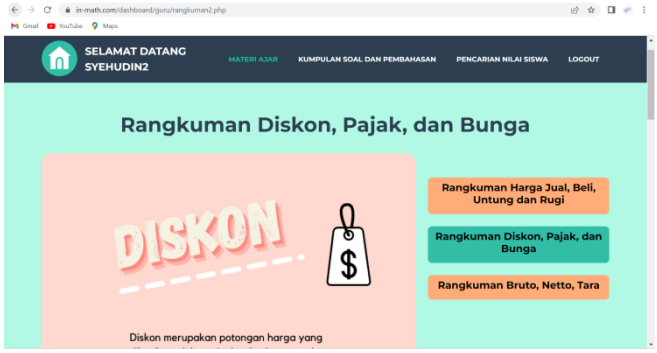

Fig. 14. Teacher summary page.

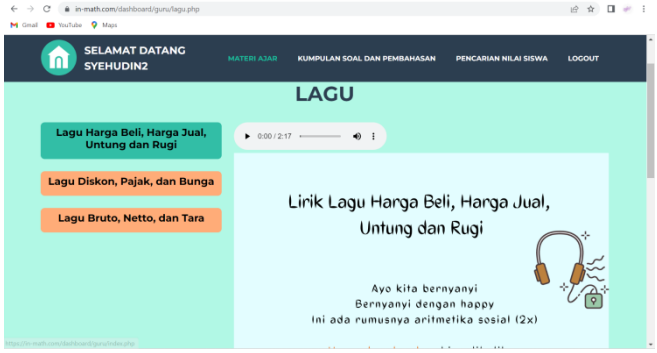

Fig. 15. Teacher page song.

16) *A collection of questions and teacher discussion pages*

This page contains a collection of questions from the quizzes done by students along with their discussions for the entire sub-discussion. A collection of questions and teacher discussion pages presented in Fig. 16.

Fig. 16. Questions and teacher discussion page.

17) *Student grades search page*

On this page the teacher can see the results of quizzes by each student. There is a box to write the name of the student you want to see the results. The student's results appear after typing the student's name. The number 1 indicates the student is working on the number correctly while the number 0 indicates the student's answer to the number is wrong. Students' scores are divided into 3 sub-discussions that are the same as the ones done during the quiz, namely selling price, purchase price, profit and loss; discounts, taxes and interest; and gross, net, and tare. The student grades search page presented in Fig. 17.

18) *Admin main page*

On the main admin page there is a brief explanation of In Math. There is a menu bar above to edit users and edit content as well as the admin role in the In Math e-learning. The admin main page presented in Fig. 18.

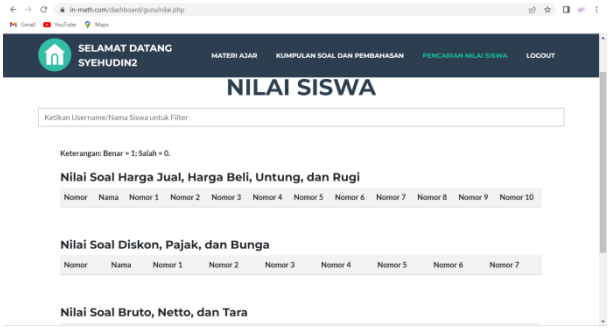

Fig. 17. Student grade page.

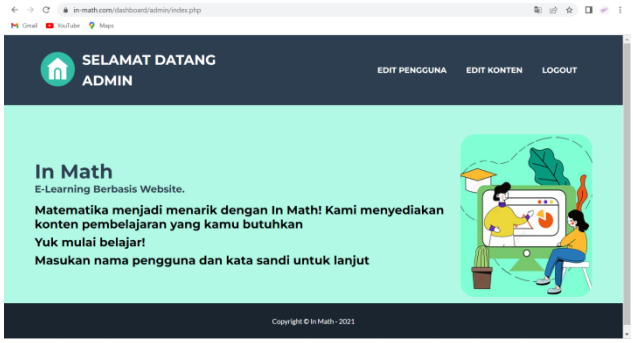

Fig. 18. Admin main page.

19) *User edit options page*

This page is used for admins to choose to edit teacher or student users. The User edit option page presented ini Fig. 19.

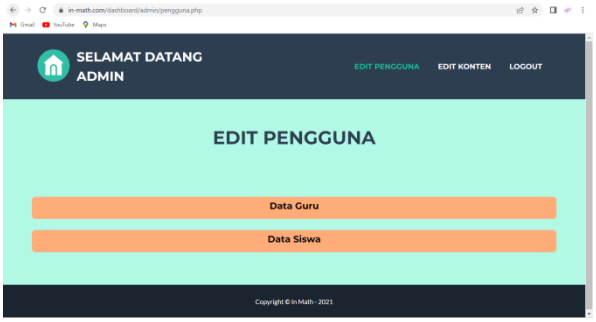

Fig. 19. User edit options page.

20) *User edit page*

The function of the user edit menu for both teachers and students is to accept or reject new accounts registered to enter the In Math system. If there is no registered account then the page will look like the first picture. Meanwhile, when an account is registered, it looks like the second picture. Admins can choose to accept or reject the account by clicking on the appropriate button. The user edit page presented in Fig. 20.

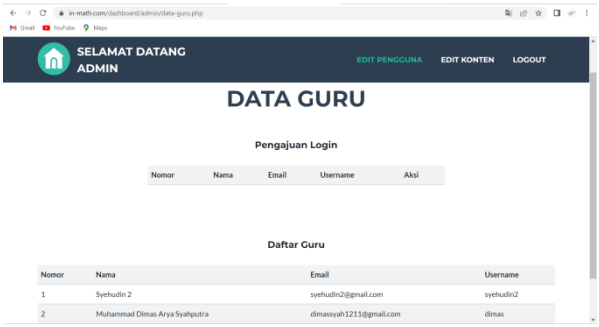

Fig. 20. User edit page.

21) Content editing options page

The admin has the function of changing the content provided. This function can change the available videos, summaries, or songs. Content editing options are available on this page. The content editing option page presented in Fig 21.

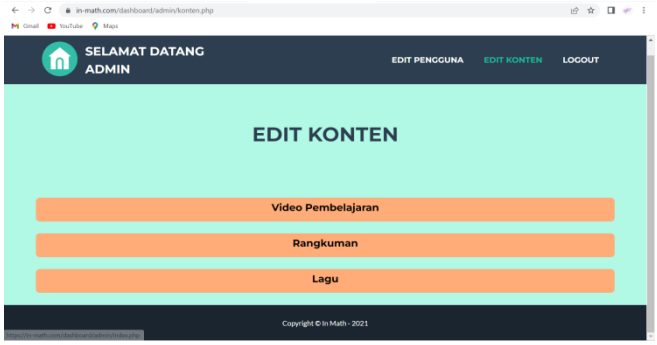

Fig. 21. Content editing option page.

22) Video content edit page

On this page the admin can replace the existing video with a new video that is tailored to the needs by clicking the "Choose file" button, then selecting the desired file, then clicking "Replace". The video will then change on the student and teacher accounts according to what was replaced. The video content edit page presented in Fig. 22.

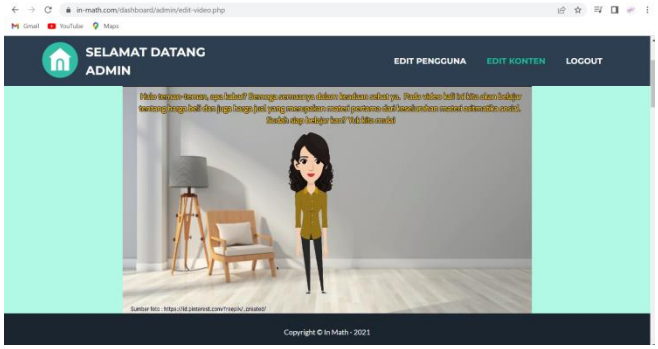

Fig. 22. Video content editing page.

23) Summary content edit page

On this page, the admin can replace the existing summary with a new summary that is tailored to the needs by clicking the "Choose file" button, selecting the desired file, then clicking "Change" to change the summary on the student and teacher accounts according to what was replaced. The summary content edit page presented in Fig. 23.

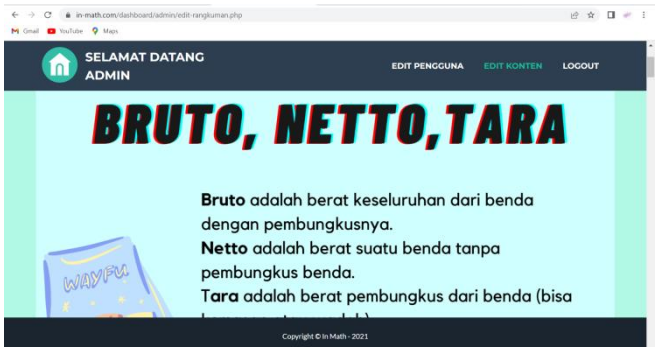

Fig. 23. Summary content edit page.

24) Song content edit page

On this page, the admin can replace the audio of an existing song and song lyrics with a new one that has been adjusted by clicking the "Choose file" button and then selecting the desired file. By clicking "Change", the song audio and song lyrics will change on the student and teacher accounts in accordance with the replaced content. The song content edit page presented in Fig. 24.

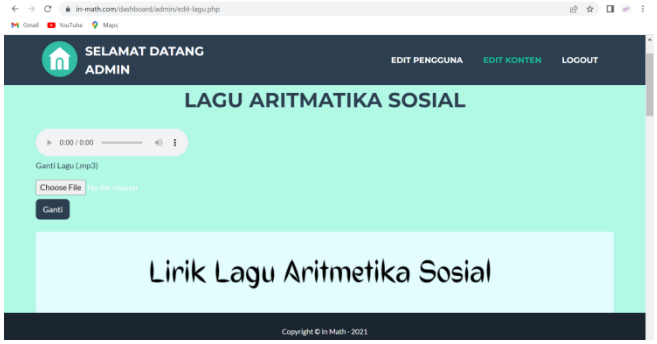

Fig. 24. Song content edit page.

Further details relating to the website can be accessed via the following link: http://in-math.com/

IV. Conclusion

Based on the results of research and discussion, several things can be concluded, as follows: 1) The development of the website-based e-learning In Math for Grade VII students went through five stages, namely the preliminary research stage which was carried out by conducting interviews with teachers and distributing needs analysis questionnaires to junior high school students from one of the schools in Jakarta. The planning stage began with an outline of media content (GBIM), material descriptions (JM), and storyboards as guidelines for creating the In Math e-learning. The validation and revision stages were conducted with the participation of material and language experts as well as media experts, followed by the small group trials stage for teachers and students, and finally the last stage of large group trials for teachers and students. 2) The resulting In Math website-based e-learning was developed based on: a) validation from material and language experts that resulted in a percentage of 85.42% so it can included in the "very appropriate" category; b) validation of product media experts saw the product to be in the "very appropriate" category with a percentage of 83.39%; c) small-scale trials by teachers received a percentage of 75% which is in the "appropriate" category and 86.67% from students which is in the "very feasible" category; d) large group trials conducted on teachers received a percentage of 95.2% and 86.25% for students, which falls into the "very decent category" for both. So based on the percentage results of all stages of development, it can be concluded that the In Math website-based e-learning that was developed is feasible and can be used by teachers and students as a learning medium. The overall assessment of the feasibility of the developed product obtained a percentage of 85.23% and falls into the "feasible" category.

Conflict of Interest

The author declares no conflict of interest.

AUTHOR CONTRIBUTIONS

Tri Murdiyanto and Dwi Antari Wijayanti validated the instruments needed for needs analysis and assessment questionnaires. Nyla Farhatul Maula conducted research in schools. Anny Sovia wrote the paper. All authors had approved the final version.

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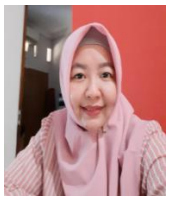

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