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Etnolamp: Integrating Lampung Ethnomathematics into Articulate Storyline for Contextual SPLDV Learning

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Abstract

Integrating local cultural knowledge into digital mathematics learning remains underexplored despite growing interest in culturally responsive education. This study developed and evaluated **Etnolamp**, an interactive ethnomathematics learning environment that combines Lampung cultural contexts with Articulate Storyline to support contextual learning of Systems of Linear Equations in Two Variables (SPLDV). The study employed a research and development approach adapted from the Borg and Gall model, encompassing needs analysis, product design, expert validation, revision, and limited classroom implementation involving 16 ninth-grade students in Indonesia. Data were collected through interviews, expert validation instruments, and student response questionnaires to evaluate the product's validity and practicality. The findings indicate that Etnolamp achieved high expert validation and was perceived by students as a practical and engaging learning resource. By integrating instructional materials, interactive videos, contextual exercises, educational games, and culturally relevant mathematical problems into a single digital platform, the media promoted meaningful connections between abstract algebraic concepts and students' everyday cultural experiences. This study contributes a culturally responsive multimedia design framework that demonstrates how ethnomathematics and interactive digital technologies can be integrated to support contextual mathematics learning, providing a foundation for future investigations into its effectiveness in improving mathematical understanding and problem-solving.

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INTRODUCTION

Junior high school students are in a transitional developmental stage characterized by high curiosity and exploration, making culture-based learning particularly appropriate (Ratriana et al., 2021). (Nurhanurawati et al., 2022) state that mathematics teachers should implement learning that involves students in solving real-life problems, whether frequently encountered or rarely encountered but still relevant, so that students' abilities to formulate, apply, and reason can develop through the use of their thoughts in problem-solving. Learning mathematics in line with the cultural

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context is appropriate for junior high school students, enabling them to address everyday life problems (Hendriyanto et al., 2023).

The concept of ethnomathematics refers to mathematical ideas embedded in cultural practices and everyday life (D'Ambrosio, 1985). Ethnomathematics connects mathematics with students' cultural backgrounds and social experiences, making learning more contextual and meaningful (Abidin & Usman, 2021; Baihaqi et al., 2025; Mairing et al., 2024; Nursyahidah et al., 2025). Lampung culture provides rich ethnomathematical contexts that can support contextual mathematics learning. Cultural elements such as Tapis Lampung, local commodities, and traditional practices can be incorporated into SPLDV problems to help students connect mathematical concepts with real-life experiences (Khasanah et al., 2025; Loviana et al., 2020; Rusmaya et al., 2025; Sari & Loviana, 2025; Suherman & Vidákovich, 2022).

Digital learning and interactive multimedia can enhance student engagement, improve learning accessibility, and support meaningful learning experiences (Asyhari & Komikesari, 2024; Febrini et al., 2024; Harisman et al., 2025; Lin et al., 2017; Nurhidayat et al., 2025). In mathematics education, learning media play an important role in facilitating students' understanding of concepts and improving learning effectiveness (Ulfahyana & Herwandi, 2024). Interactive learning media are increasingly recognized as effective tools for creating engaging and learner-centered learning environments (Adeoye et al., 2025; Atmaja & Samdudin, 2024; Fadiyah et al., 2023; Yakubu et al., 2025). Articulate Storyline enables the integration of text, images, audio, video, animation, and interactive activities into a single learning environment, making learning more interactive and engaging (Dahlan & Sriyanto, 2024; Sari et al., 2021; Sindu et al., 2020). Furthermore, Articulate Storyline can facilitate the integration of real-world problems and local cultural contexts, making learning more contextual and meaningful for students (Kua et al., 2024). The integration of multimedia and local cultural contexts can further support meaningful learning experiences and improve student engagement (Bulkani et al., 2022). However, the integration of ethnomathematics, Lampung culture, and interactive multimedia into a coherent learning system remains limited. As a result, students often struggle to connect mathematical concepts with their cultural experiences, reducing the contextual relevance of mathematics learning.

The development of Etnolamp is grounded in Mayer's Cognitive Theory of Multimedia Learning, constructivist learning theory, and Culturally Responsive Teaching (CRT). These perspectives emphasize the use of multimedia representations, active knowledge construction, and the integration of students' cultural backgrounds to create meaningful and contextual learning experiences (Abdalla & Moussa, 2024; Cobern, 1993; Ebersole et al., 2015; Mayer, 1997; Nurhasnah et al., 2024). Accordingly, Etnolamp integrates multimedia features, contextual mathematical problems based on Lampung culture, and interactive learning activities to support students' conceptual understanding of SPLDV.

Recent studies have highlighted the growing importance of ethnomathematics in contextualizing mathematics learning and connecting mathematical concepts with students' cultural experiences, thereby promoting meaningful learning and cultural awareness (Nursyahidah et al., 2025; Suherman & Vidákovich, 2022). A recent literature review showed that ethnomathematics has become an increasingly important approach for linking school mathematics with local cultural knowledge and everyday practices, helping students develop deeper conceptual understanding and appreciation of cultural diversity (Batiibwe, 2024). Furthermore, a meta-analysis study reported that ethnomathematics-based learning has a positive effect on students' mathematical literacy and learning outcomes (Pratama & Yelken, 2024). Recent systematic reviews have also indicated a growing trend toward integrating technology with ethnomathematics to create culturally responsive and meaningful learning environments (Sunzuma & Umbara, 2025). In parallel, interactive learning media developed using Articulate Storyline have demonstrated effectiveness in improving students' conceptual understanding, engagement, and learning outcomes in mathematics education (Andriani et al., 2024).

Although previous studies have explored ethnomathematics-based learning and interactive multimedia separately, limited studies have integrated ethnomathematics, Lampung cultural contexts, and interactive multimedia within a single learning environment for SPLDV learning. However, many existing learning media still focus on either cultural integration or multimedia interactivity, with limited efforts to combine both aspects within a single learning environment for

mathematics learning. Furthermore, SPLDV is an abstract topic that many students find difficult to understand because it requires students to translate real-world situations into mathematical models and solve them systematically. The novelty of this study lies in the development of Etnolamp, an ethnomathematics-based learning media that integrates Lampung cultural contexts and interactive multimedia through Articulate Storyline to support SPLDV learning. Therefore, this study aimed to develop and evaluate the validity and practicality of Etnolamp for ninth-grade students learning SPLDV.

METHOD

Research Design

This study adopted the Borg and Gall research and development (R&D) model as the methodological framework for developing the Etnolamp learning media. The original Borg and Gall model consists of ten systematic stages designed to guide the development and validation of educational products (Gall et al., 2007). However, in this study, a simplified version of the model was used by adapting it into seven stages to fit the scope and practical needs of the research context. The adapted stages include: (1) preliminary study and needs analysis, (2) design or media development, (3) initial product development, (4) expert validation, (5) revision of the initial product, (6) limited testing, and (7) final revision. The purpose of this study was to develop an ethnomathematics-based learning media grounded in Lampung culture using Articulate Storyline that is valid and practical for the topic of Systems of Linear Equations in Two Variables (SPLDV).

Participants

The limited-scale trial involved 16 ninth-grade students from class IX-A at SMP Tamaddun Roudlatul Qur'an. The participants had previously studied the SPLDV topic and were selected to evaluate the practicality of the developed learning media. Revisions were made based on expert feedback before the product was implemented in the limited trial.

Validators

The validation instruments consisted of three expert validation sheets: content (material) validation, media validation, and cultural validation. Each validation sheet was assessed by two experts in the respective field. Accordingly, content validation was conducted by two content experts, media validation by two media experts, and cultural validation by two cultural experts. The validators involved in this study were selected based on their expertise in mathematics education, educational media development, and Lampung cultural studies. All validators held relevant academic backgrounds and had more than five years of professional experience in their respective fields, making them well-qualified to evaluate the developed product. Each validation sheet comprised 10 items designed to assess the quality of the ethnomathematics-based learning media developed using Articulate Storyline.

Instruments

Data were collected using expert validation sheets and a student response questionnaire. The validation sheets were used to assess the content, media design, and cultural appropriateness of Etnolamp. Meanwhile, the student response questionnaire was administered after the limited-scale trial to evaluate the practicality of the media. All instruments employed a five-point Likert scale consisting of: 1 = not good, 2 = poor, 3 = fairly good, 4 = good, and 5 = very good. The scores obtained from each instrument were converted into percentage values to determine the validity and practicality levels of the developed product.

Data Analysis

The data obtained from expert validation and student response questionnaires were analyzed descriptively using percentage techniques. The percentage score was calculated using the following formula:

$$P = (\text{Obtained Score} / \text{Maximum Score}) \times 100\%$$

where P represents the percentage score, the obtained score refers to the total score assigned by validators or students, and the maximum score refers to the highest possible score. The resulting percentages were used to determine the validity and practicality levels of the developed media. Higher percentage scores indicate a higher level of validity and practicality. Suggestions and comments provided by validators were analyzed qualitatively and used as the basis for revising and improving the product before implementation in the limited-scale trial.

RESULTS AND DISCUSSION

This part provides information about the research findings and their discussion. Findings of the study will be provided in an appropriate form, such as the use of tables and graphs for proper understanding. The discussion is divided into several sub-parts. In this study, Etnolamp learning media was created through the simplified Borg & Gall development process involving seven steps, namely: (1) Preliminary study and needs analysis; (2) Design or development of media; (3) Initial product development; (4) Expert validation; (5) Revision of the initial product; (6) Limited testing; and (7) Revision of the testing process.

Preliminary Study and Needs Analysis

This is the most significant part of the research process where the researcher carried out the needs analysis, consisting of the determination of students' characteristics, assessment of learning activities, and definition of learning objectives. The data was gathered via semi-structured interviews conducted with one mathematics teacher in Metro City. In the course of interviewing, attention was paid to students' learning problems, utilization of existing instructional media, and the necessity to create culturally based learning materials. According to the results of analyzing the data obtained, students face problems of understanding abstract concepts of mathematics when learning is not linked to their cultural background. The teacher also mentioned that current instructional media lack interactivity and cultural significance for the Lampung community. Thus, it is necessary to create new types of instructional media to improve the students' understanding of abstract mathematical concepts. The main drawback of this research is the use of just one teacher in the sample.

Design or Media Development

Based on the needs analysis, a learning media model is designed that incorporates visual, audio, and interactive elements. This design aims to align with students' characteristics and the cultural context of Etnolamp. The researcher develops an innovation in the form of interactive learning media based on Articulate Storyline. This media allows students to learn independently on Android devices while becoming familiar with the surrounding culture. The media design aims to provide a more engaging, interactive learning experience that meets students' needs in the material. Below is figure 1 presents the interface displays of the Etnolamp learning media, which illustrate the main features of the developed product.

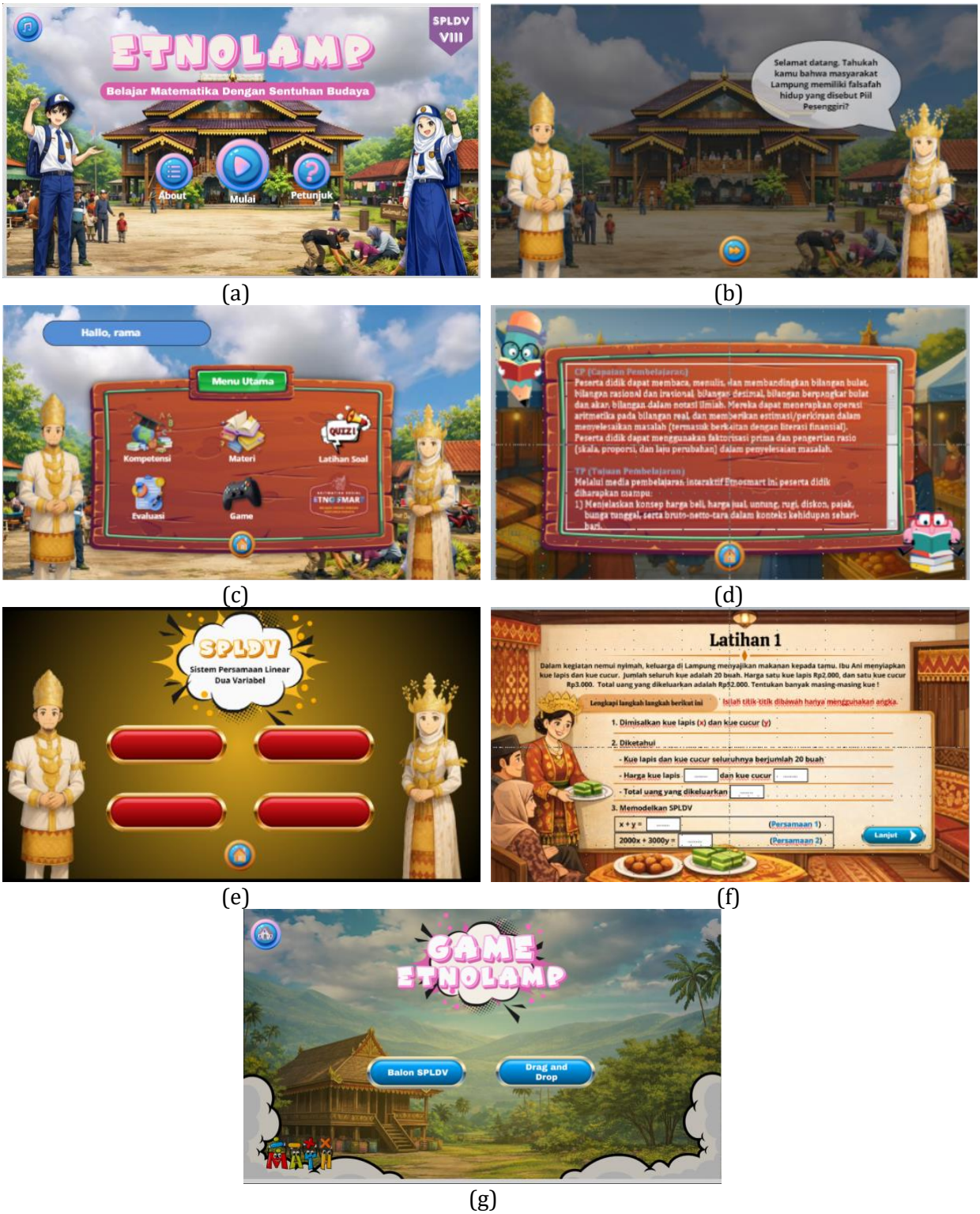


Figure 1. Main Interfaces of the Etnolamp Learning Media. (a) Login Page; (b) Introduction Page; (c) Main Menu; (d) Competencies Page; (e) Learning Materials Page; (f) Practice Exercise Page; (g) Educational Games.

After the first step, there is an introduction part which includes dialogues between two characters where the students will be able to read and listen to the conversation before moving on to the learning activities. This is meant to make the students interested and help connect the mathematics knowledge to the culture in the media. The main menu provides access to some elements of Etnolamp, including the learning competencies, instructional materials, practice exercises, evaluation, and educational games. The learning competencies provide the learning

objectives for the lesson, whereas instructional materials let the students discover the concept of System of Linear Equations in Two Variables (SPLDV). Practice exercises give the students the task to solve the SPLDV equation questions in all steps of the answer. Furthermore, educational games are provided for the students to learn through playing games like SPLDV Balloons and Drag and Drop games.

Initial Product Development

Once the design process is over, the first educational product is created. Such media comprises elements like instructional videos, games, and interactive quizzes. All these are systematically created in order to increase student participation. By using several kinds of media in the creation of such products, various ways for presenting information are provided to learners, which helps in increasing their involvement in learning. Moreover, the presence of interactive quizzes ensures that there is some level of active student participation during the learning process.

Expert Validation

The first validation of the product Etnolamp was done by media experts, content experts, and cultural experts. This validation process was intended to gather input concerning the media content, usability, design, and the ability to deliver instruction through the learning media. The result of this validation process was used as the basis for improving the media before doing limited trial on the students. For content experts, the review focused on content accuracy, appropriateness of content, and clarity of language. On the other hand, media experts focused on usability, writing quality, visual, and audio aspects of the media. Cultural experts, on the other hand, reviewed the appropriateness of the integration of the culture of Lampung in the learning materials. See the results presented in the following table 2.

Table 2. Expert Validation

Validator Category	Validator	Percentage (%)	Criteria
Media Expert	Validator 1	84	Very Valid
	Validator 2	84	Very Valid
Content Expert	Validator 1	82	Valid
	Validator 2	82	Valid
Cultural Expert	Validator 1	84	Very Valid
	Validator 2	86	Very Valid
Average		**83.6**	**Very Valid**

The results of the expert validation show that the ethnomathematics-based learning media using Articulate Storyline (Etnolamp) received a percentage of 83.6%, with the criterion of very valid. This indicates that the Etnolamp learning media is suitable for use in learning. The validity of Etnolamp can be attributed to the alignment between the learning content, multimedia design, and cultural context embedded in the media (Ikhsan et al., 2024; Prasasti & Anas, 2023). The integration of Lampung cultural elements was not merely decorative but was systematically incorporated into learning materials, examples, worksheets, and problem-solving activities related to SPLDV. This alignment supports the principles of culturally responsive teaching, which emphasize the importance of connecting learning experiences with students' cultural backgrounds. Furthermore, the use of Articulate Storyline enabled the presentation of learning materials through multiple representations, including text, images, audio, and interactive activities, which contributed to the coherence and instructional quality of the developed media. Therefore, the high validity score reflects not only the appropriateness of the content but also the consistency between pedagogical objectives, cultural integration, and multimedia design.

These results are relevant to the research conducted Nissa et al. (2021), which found that the Android-based learning media developed with Articulate Storyline software meet the criteria for validity and suitability for use in mathematics learning in schools. Furthermore, Nabila et al. (2023) it also states that the developed ethnomathematics-based learning media are valid and suitable for use in learning. The validity score (83.6%) is influenced by the alignment between the learning

content, ethnomathematics principles, and the use of Articulate Storyline, which makes the material more structured and relevant. Integrating Lampung cultural elements is expected to make mathematical concepts more meaningful for students.

Furthermore, the consistency of expert judgments was examined based on the similarity of scores from the six validators. The media experts assigned scores of 84 and 84, the content experts assigned scores of 82 and 82, and the cultural experts assigned scores of 84 and 86. The close range of scores indicates a good level of agreement among the validators in assessing the material, media, and cultural aspects of the Etnolamp learning media. This consistency supports the reliability of the validation process and strengthens the validity of the developed product.

The media trial was conducted by the researcher with students in class IX A at SMP Tamaddun Roudlatul Qur'an, consisting of 16 students, to determine students' responses after using the Etnolamp learning media. Table 3 shows the aspects and indicators used to evaluate the learning media, including ease of use, content and animation, language, text clarity, and integration of design elements.

Table 3. Table of Specifications of the Student Response

Aspect	Indicator	Item Number
Ease of Use	Ease of using the media and understanding the material	1, 2
Content & Animation	Attractiveness of animation, presentation of material, and accuracy of examples	3, 4, 5
Language	Ease of understanding the language	6
Text	Clarity of text in the media	7
Integration	Suitability of menus, buttons, background, and music	8,9,10

The ten statements were summed using a Likert scale, with a maximum score of 5 per item, ranging from "not good" to "very good". The total score from 16 students was 620. The maximum possible score was 800, resulting in a percentage of 77,5%. Table 4 shows the results of the students' responses to the Etnolamp learning media.

T**able 4.** Student Response Results

Assessment Aspect	Value
Highest Score	800
Score Achieved	620
Percentage (%)	77.5%
Criteria	Practical

The student response results indicated that the ethnomathematics-based learning media developed using Articulate Storyline, namely Etnolamp, achieved a practicality score of 77.5%, indicating that the media was categorized as practical for use in learning activities. The practicality score of 77.5% indicates that the media is quite practical to use, but not yet optimal. Although the overall practicality results were categorized as practical, several indicators received lower scores, particularly those related to navigation and clarity of instructions. Students also suggested adding pause functionality to the instructional videos, increasing the number of games, and correcting several spelling errors. In response to feedback from both students and experts, revisions were made to improve the visual layout, simplify navigation and instructional language, correct writing errors, and enhance the clarity of contextual examples. These revisions contributed to making the media more user-friendly and easier to use during the learning process.

The practicality of Etnolamp may be explained by its user-friendly design and accessibility. Students were able to navigate the learning materials independently through clearly organized menus, interactive exercises, and immediate feedback features. The integration of instructional videos, practice activities, and educational games provided varied learning experiences that reduced monotony and maintained student engagement. In addition, the media could be accessed through mobile devices, allowing students to learn flexibly according to their own pace (Tarigan & Ahkas, 2023). These characteristics are consistent with the principles of learner-centered digital learning

environments, which emphasize ease of use, accessibility, and active student participation (Asyhari & Komikesari, 2024; Yakubu et al., 2025).

These findings align with research conducted by Khusnah et al. (2020), which asserts that Articulate Storyline-based learning media meet practicality criteria and are suitable for use in mathematics education. Additionally, this outcome is consistent with the study Machmud et al. (2022), which also states that Articulate Storyline-based learning media fulfill the practicality criteria and can be effectively utilized in the learning process. Ethnomathematics helps contextualize mathematical concepts within students' cultural experiences, making them more meaningful and easier to understand. However, ethnomathematics alone is insufficient; without appropriate instructional design, cultural integration can become superficial. Therefore, interactive media plays an important role in transforming static cultural contexts into dynamic, engaging, and accessible learning experiences, thereby increasing students' motivation and engagement (Febrini et al., 2024; Prasasti & Anas, 2023).

The incorporation of Lampung cultural contexts also contributed to making SPLDV concepts more meaningful for students. One of the main difficulties in learning SPLDV is translating real-world situations into mathematical models. By embedding mathematical problems within familiar cultural contexts, such as local products, traditional practices, and elements of Lampung heritage, students were provided with situations that were easier to visualize and relate to their everyday experiences. This contextualization can reduce the abstractness of mathematical concepts and support students in constructing mathematical meaning. From a constructivist perspective, learning becomes more effective when new knowledge is connected to learners' prior experiences and sociocultural backgrounds (Abidin & Usman, 2021).

In addition to confirming the previous studies, this paper contributes to knowledge by illustrating that it is possible to combine ethnomathematics with interactive media into the learning process of mathematics. In such a combination, ethnomathematics helps in making a connection with the cultural identity of the learners, whereas interactive media assists in making the learning process more interactive. However, there still needs to be some research to explore the effectiveness of the above combination.

Revision of the Initial Product

According to recommendations from experts, the background music in the developed product has been deleted since it was thought to distract students from concentrating on their activities. Concerning the exercises, there were five exercises developed separately to assist students in working on the assignments based on the learned material. Earlier, the entire exercise was placed in one section, which meant that students needed to finish one exercise before proceeding to another exercise. Such requirements rendered the media ineffective. Moreover, the design of the media has been modified in order to render it more attractive to the users. Besides, the teaching module has been updated to facilitate its compliance with the learning process conducted with the use of the Etnolamp media. Furthermore, the student worksheet has been updated accordingly as well.

The uniqueness of the Etnolamp learning media lies in the presence of Lampung ethnomathematics in learning media used for the learning process of SPLDV. The Etnolamp media consists of teaching modules, video lessons, and student worksheets that use components of Lampung culture in mathematical tasks and problems. From the expert validation stage, the use of cultural background was seen to make the learning media become more relevant and understandable, whereas at the student validation stage, the combination of the visual media with contextual activities contributed positively towards making the learning process engaging and easier. Moreover, there are exercises provided in Etnolamp through which students can verify their answers by inserting the results from the worksheets they obtain.

Apart from encouraging students to take an interest in learning mathematically, the media also incorporates game-like components, which can make learning math entertaining and less boring for the students. Moreover, the creation of Etnolamp is done based on the whole language approach, in which the listening, reading, writing, and speaking abilities of the students are integrated during the process of learning mathematics. During the learning process, students get engaged in listening activities by listening to teachers' explanation of SPLDV in the cultural context, reading mathematical stories/problems, writing mathematical solutions and interpretations using their own language, and

talking about their solutions and strategies orally. With the integration of these linguistic abilities, it is expected that learning activities would help students gain meaningful knowledge of SPLDV and mathematical communication skills. The other positive aspect of this media is the ease of accessing it. It can easily be sent through a link, making it easy for teachers to send it and students to access it anywhere and anytime.

Limited Testing

The pilot testing of the new educational materials involved 16 students. During this period, the main goal is to observe the reaction of the learners and see how far the materials will be able to facilitate learning. The main focus of this phase is to collect information on how useful and effective the new materials will be. Feedback collected at this stage becomes crucial in determining any areas that need improvement. These improvements are needed before the application of the materials can take place. Generally, the idea behind this stage is to ensure that the material is appropriate and realistic for use in an educational setting.

Revisions Based on Testing

Feedback from this limited testing indicated several areas requiring further work. Based on information gathered from students' experiences, certain final amendments have been made to improve the quality of the learning materials used. Such modifications are crucial so as to make sure that the learning materials would be more effective and useful. The learning materials, after modification would now be prepared for further trial. This process would make the learning materials much easier and interesting to use, thus increasing the feasibility of their usage during learning activities. Nevertheless, as this study has limited itself to practicality testing only, more studies are required for the evaluation of its effectiveness.

LIMITATION

The Etnolamp learning media can only be used to learn SPLDV, meaning that the range of contents is still limited since it has yet to offer any chance for students to learn other related mathematical contents. As a result, there will never be any real-time content updates as well as interactive learning, since the media cannot be integrated into LMS and online discussion tools for monitoring the learning activities. In order to solve such a problem, future improvement needs to focus on integrating the learning media with LMS, online discussion tools, and learning analytics tools for increasing the interactivity and collaboration. At the same time, teams need to concentrate on designing their media efficiently. From the current perspective, the design of Etnolamp should also be enhanced regarding its visuals, sound, and music.

CONCLUSION

Media-based learning integrated with the ethnomathematics of SPLDV was created based on the R&D process by Borg & Gall, named Etnolamp, which uses Articulate Storyline. The results obtained reveal that the media is valid (83.6%) and practically useful (77.5%). Therefore, it can be stated that media development using ethnomathematics is feasible and can be applied to classroom learning, but it is still not optimal. The most important implication from this research is to prove that the use of ethnomathematics with an interactive media design, through the creation of Etnolamp, is feasible in practice. The present research contributes to previous research, not only because it stresses the importance of cultural significance but also due to its demonstration in practice of interactive media design for teaching mathematics. However, the result of the practicality of the media shows that there is a need to develop the design and improve the usability of the media. Because this research only focused on validity and practicality, the next step should be carried out to measure the effectiveness of the media on learning achievements.

AUTHOR CONTRIBUTIONS

SL contributed to the conceptualization, methodology, investigation, data curation, formal analysis, and writing of the original draft. SSu was responsible for supervision, validation, methodology, and reviewing and editing the manuscript. FA contributed through supervision, validation, and manuscript review and editing. SSo participated in the investigation, data curation, and resource provision. NN contributed to the validation, formal analysis, and manuscript review and editing. All authors have read and approved the final version of the manuscript.

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