Al-Ishlah: Jurnal Pendidikan
Vol.17, 3 (September, 2025), pp. 4498-4509
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v17i3.4712

Development of Student Worksheets Based on Contextual Teaching and Learning Integrated Malang Culture for Elementary School Students

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ARTICLE INFO

Keywords:

development;
student worksheet;
contextual teaching and learning;
Malang culture

Article history:

Received 2023-10-13
Revised 2024-12-02
Accepted 2025-09-26

ABSTRACT

This study aimed to develop a student worksheet based on Contextual Teaching and Learning (CTL), integrated with Malang culture, to improve fifth-grade students' understanding of fractional operations. Incorporating local cultural elements into mathematics instruction is intended to increase student engagement and contextual comprehension. The research employed a Research and Development (R&D) design using the ADDIE model, which includes five phases: Analysis, Design, Development, Implementation, and Evaluation. The worksheet was designed around seven CTL components: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. Data collection instruments included interviews, expert validation sheets, and student response questionnaires. Descriptive analysis was used to evaluate the validity and practicality of the product. Validation was conducted by four experts in material (84.70%), media (80%), language (93.33%), and teaching practice (97.5%), indicating that the worksheet was "very valid" and suitable for classroom use. Implementation with fifth-grade students showed enhanced engagement and understanding, particularly in solving addition and subtraction of fractions with unlike denominators. The integration of CTL strategies and local cultural content, supported by colorful visuals and contextual examples, created a more interactive and meaningful learning experience. Student feedback and performance gains demonstrated the worksheet's effectiveness in supporting conceptual understanding and increasing motivation. The developed CTL-based worksheet, enriched with Malang cultural context, is valid, feasible, and effective for improving fractional learning in elementary mathematics classrooms.

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1. INTRODUCTION

Elementary school mathematics learning has five components that must be mastered by students, including understanding, problem-solving, reasoning, interrelation or relationship, and communication (Yore et al., 2007). The five components will be realized if one of them is supported by learning media. Learning media are tools or supporting facilities to deliver teaching materials during learning. Learning media can be in the form of audio, visual, and audio-visual (Koenig & Holbrook, 1995). One example of visual learning media is student worksheets. Using student worksheets in learning can make students more active, stimulate students while learning, and provide variations to learning so students do not get bored easily (Utami, Ruja, & Utaya, 2016; Yaden, 2017). Student worksheets can make learning constructive, namely as a guide for students in discovering the concepts being studied (Simamora & Saragih, 2019). So, student worksheets can add motivation and understanding of concepts to help students become successful in learning.

Another factor that can influence the success of learning is the use of learning models (Lee-Post, 2009; Yengin, Karahoca, & Karahoca, 2011). Using learning models becomes a bridge between teaching materials and students so that learning activities become more focused. The use of the learning model used by the teacher must be adapted to the characteristics of the students, the material to be delivered, and the learning environment. Teachers must use learning models that can involve students to be mentally, physically, and socially active so that students' abilities can develop and learning objectives can be achieved (Brophy, 1986; Nurlaily, Soegiyanto, & Usodo, 2019). One learning model that has a positive impact on students' achievement is Contextual Teaching and Learning (Hudson & Whisler, 2007). Jhonsons argues that contextual learning can stimulate students' thinking power, persistence, and enthusiasm in working on fractional arithmetic operations and train students to think systematically (Johnson, 2002). So, contextual teaching and learning help students understand mathematics easily.

Information about teacher interaction with students can be presented through student worksheets. This interaction is intended so that students can be independent in learning. The utilization of student worksheets becomes more optimal using contextual learning models. In line with Nilasari, who said students would learn to understand the meaning of information learned through contextual learning by applying it in their daily lives (Nilasari, Djatmika, & Santoso, 2016). In addition, students' memory becomes more substantial for the material being studied because they are not required to memorize (Ariani & Yolanda, 2019). Student worksheets based on contextual teaching learning make students more active, structured, and more responsible for their learning (Johnson, 2002). This result proves that contextually-based student worksheet learning positively impacts students.

Students' level of development and experience determines their ability to learn in contextual learning. However, in one of the studies conducted by Mahmud & Pratiwi, it was-found that students could not apply mathematics in their daily lives (Mahmud & Pratiwi, 2019). Therefore, it is necessary to have supporting facilities that can address everyday problems in learning, one of which is through a local culture that is characteristics of the school. Local culture is included in the sociocultural realm, which is currently one of the contexts for compiling the minimum competency assessment in the current government's new policies. The five factors that can affect the achievement of numeracy literacy in Indonesia include facilitating factors, learning resources factors, facilities and infrastructure factors, education unit and community involvement factors, and governance factors (Kemendikbud, 2022).

Fiangga revealed that not all elementary school teachers accustom their students to working on numeracy literacy-based questions in learning (Fiangga, 2013). Therefore, actions are needed to support the numeracy literacy movement, such as teacher training activities to create supporting media and implement daily problems or local culture that can be used in school characteristic-based learning (Kemdikbud, 2017). Increasing students' ability in literacy can also be linked to personal, sociocultural, and scientific contexts. Learning the sociocultural context must be linked to local wisdom and archipelago culture, family, and society because students know what cultures exist around them and are used to preserving them. In addition, this sociocultural context is contextual, which can help students' memory become more vital and not fictitious (Syaifuddin, 2017). Connecting mathematics learning

materials with the surrounding environment helps students understand the learning materials and know about the culture in their environment.

However, the use of supporting media for mathematics instruction has not yet been widely implemented in several elementary schools, including MIS Miftahul Huda Jabung Malang. Based on interviews conducted with Mr. Fikri, a mathematics teacher for Class VA, mathematics instruction at the school still relies solely on government-issued textbooks and student worksheets as learning resources. As a result, the learning process tends to be teacher-centered, with minimal student engagement or interaction. Observations in Class VA further revealed that students appeared disengaged, and the delivery of mathematical content was less effective. Students were not actively involved in learning activities, primarily due to the lack of creative teaching strategies and innovative learning media. Additionally, interview findings indicated that students performed poorly in topics related to addition and subtraction of fractions with different denominators.

These findings highlight the need to develop contextual, student-centered learning materials that can enhance student understanding and engagement. This is consistent with Nareswari (2021), who emphasized that student worksheets (LKS) should be designed to help students grasp abstract mathematical concepts more easily. Several researchers, including Shofia Hattarina, Dek Ngurah Laba Laksana, and Ermelinda Yosefa Awe, have developed worksheets based on Contextual Teaching and Learning (CTL) or local cultural contexts. For example, Hattarina et al. (2022) designed CTL-based worksheets tailored to Grade 5 students; Laksana et al. (2020) focused on critical thinking through contextual resources; and Awe et al. (2021) incorporated cultural themes in teaching the concept of heroes for Grade IV.

However, these studies did not integrate CTL-based worksheets with local culture, specifically in the context of fractional operations. Therefore, this research is distinct in its aim to develop CTL-based student worksheets integrated with Malang's local culture—specifically in the context of traditional harvest practices and regional culinary traditions. This integration is intended not only to improve students' understanding of fractions but also to foster cultural awareness and better prepare them for Minimum Competency Assessments (AKM) that often involve sociocultural contexts. Consequently, this study seeks to develop a valid and practical CTL-based worksheet incorporating Malang culture to enhance the teaching and learning of fraction operations at MIS Miftahul Huda Jabung Malang.

2. METHODS

This study employed a Research and Development (R&D) approach to develop a Contextual Teaching and Learning (CTL)-based student worksheet integrated with Malang culture for teaching fractional operations. The goal of this development research was to produce a valid and practical instructional product (Branch, 2009). The research subjects consisted of 24 fifth-grade students (Class VA) at Madrasah Ibtidaiyah Miftahul Huda Jabung, Malang.

To evaluate the effectiveness of the developed worksheet, the researchers used a one-group pretest-posttest design, which enables a more accurate assessment of treatment effects by comparing student performance before and after the intervention (Knapp, 2016).

The data collected in this study aimed to provide evidence to support the product's validity and feasibility. According to Sugiyono (2008), data can take the form of facts or figures that strengthen research findings. In this study, the data were categorized into two types:

a Qualitative data were obtained from expert comments, suggestions, and feedback during validation, as well as from interviews with the classroom teacher regarding the use of learning resources, instructional models, and student learning outcomes in mathematics.

b Quantitative data were collected from the results of validation instruments completed by subject matter experts, media experts, language experts, and learning practitioners, as well as from student response questionnaires.

The development process followed the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. These stages guided the systematic development of the CTL-based student worksheet, ensuring its relevance, validity, and effectiveness for classroom application.

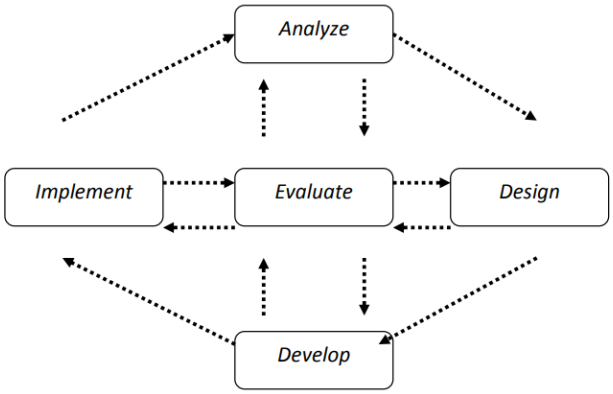

Figure 1. ADDIE Model Development Scheme (Branch, 2009)

Data validation results were processed by material experts, media experts, linguists, learning practitioners, and student response questionnaires using descriptive quantitative data analysis. Through this descriptive quantitative data analysis, the experts will assess the product that has been developed (Sugiyono, 2016).

Product trial activities were carried out on validators and subjects. This trial activity was carried out on validators to determine the validity of the product being developed, it was aimed at determining its positive impact on students through pre-tests and post-tests. The researcher observed before and after using student worksheets obtained from the responses of students and learning practitioners regarding the attractiveness of the product (Sugiyono, 2008).

An instrument is a measuring tool used to assist in collecting research data so that the data obtained becomes more valid (Sugiyono, 2008). The data collection techniques used by researchers in this study were Interview Sheets, Material Expert Validation Questionnaire Sheets, Media Expert Validation Questionnaires, Language Expert Validation Questionnaires, Learning Practitioner Validation Questionnaires, and Student Response Questionnaires on Product Attractiveness. The data analysis techniques used in this study were Descriptive Qualitative Analysis, Descriptive Quantitative Analysis, Product Validity Analysis, and Product Attractiveness Analysis.

Table 1. Validity Classification Based on Likert Scale

Achievement level (%)	Qualification	Description
84% < score ≤ 100%	Very Valid	No Revision Required
68% < score ≤ 84%	Valid	No Revision Required
52% < score ≤ 68%	Quite Valid	Required Revision
36% < score ≤ 52%	Less Valid	Revision
20% < score ≤ 36%	Not Valid	Revision

(Sugiyono, 2008)

3. FINDINGS AND DISCUSSION

Student worksheet research based on contextual teaching and learning integrated with Malang culture uses the research and development research method by adhering to the ADDIE development model, which has five stages: analysis, design, development, implementation, and evaluation. The following is an explanation of each stage of this research.

3.1. Analyze

At this stage, researchers was analyze the problems found so that it was necessary to carry out a development. According to the ADDIE development model, researchers must also analyze work gaps, identify available and needed resources, and create a work plan at this stage. To help with this analysis activity, the researcher interviewed Miftahul Huda's fifth-grade MIS teacher. The results of the analysis phase are as follows:

3.1.1 Student gap analysis

This analysis aims to find out and clarify the problems faced when learning mathematics in class V. Based on the results of the interviews, the researchers founded a problem, namely in the implementation of mathematics learning, the teacher only used textbooks and student worksheets from the government as a source of learning. So that when learning mathematics takes place, it is only centred on the teacher without any feedback from students; this results in students feeling bored and the delivery of material does not go well. The students themselves is also not actively involved in the learning process. Other information obtained by researchers in the interviews is that students get low learning outcomes in addition and subtraction of fractions with different denominators.

3.1.2 Identify available and required resources

The researchers conducted an analysis of various resources obtained through interviews with the classroom teacher. The first aspect examined was the content resources, which involved identifying and reviewing the mathematical content relevant to the topic. This process included an in-depth analysis of the mathematics textbooks currently used in the classroom to determine which materials required further development to address existing learning challenges. As part of this analysis, the researchers identified key elements such as core competencies, basic competencies, learning objectives, indicators, and the specific instructional content presented in the textbooks. Based on discussions with the teacher, it was concluded that students required additional learning support—particularly in the form of student worksheets—to better understand the topic of addition and subtraction of fractions with unlike denominators. These worksheets were seen as essential for improving students' conceptual understanding and engagement with the material.

3.1.3 Develop a work plan

Researchers developed a product development plan framework and took steps to be carried out in each stage. Researchers used this framework as a guide regarding the sequence of student worksheet learning media development.

3.2 Design

The main activity at this stage was to design or make plans about the shape and framework of the media being developed and design all the requirements needed for the next stage. Some of the activities carried out by researchers at the design stage were as follows:

3.2.1 Material selection

Based on the observation results, the material used in this student worksheet is the material for adding and subtracting fractions with different denominators. This material needs to be integrated with the local culture so that students are more familiar with the surrounding area, which is considered close to the world of students so that learning is more contextual. Fractional material is

one of the materials contained in fifth-grade mathematics learning in odd semesters. After determining the basic competencies of the material to be used as media content, the researcher developed indicators of the basic competencies that had been determined and consulted with the learning teacher. After the indicators have been set, the researcher designs the material that will be presented in the product.

3.2.2 Designing the product model

At this stage, the researcher designed a framework for student worksheet products, starting with the design, colour, content of each page, and other supporting components needed in the media realization stage.

3.3 Development

At this stage, the researcher realized the product was designed in the previous stage. To make learning media worksheets for mathematics students, the researchers carried out the following steps:

1. The researcher first created a Canva account on the web https://www.canva.com/id_id/. by signing up using email or Facebook and entering the confirmation code from the email received.
2. Then, click 'Create Design' in the upper right corner then select the size you want. Here the researcher used an A4 paper size.
3. After selecting the paper size, the researcher arranged the display order, material, font and colour match.

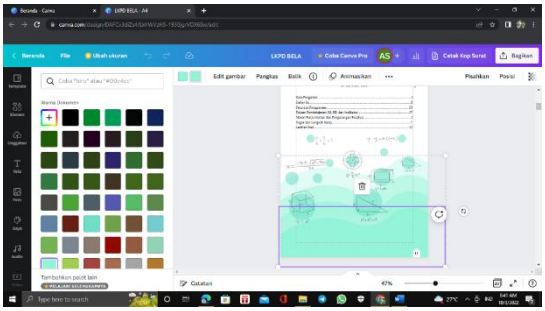

Figure 1. The process of choosing a suitable colour

4. After all the initial to final displays have been arranged, student worksheets can be saved directly and clicking the share button on the top right side, then clicking download and selecting the file type, namely print pdf.

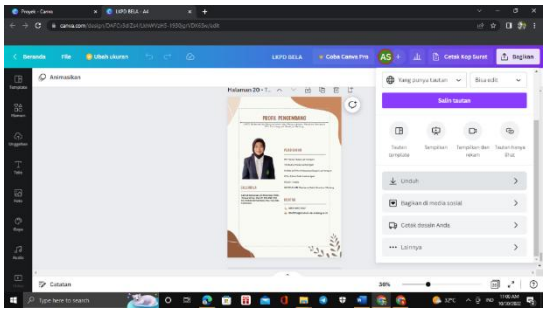

Figure 2. How to Download Files Ready to Print

5. The researcher also designed the cover or covers for students' worksheets in the same way but with different paper sizes, namely A3.

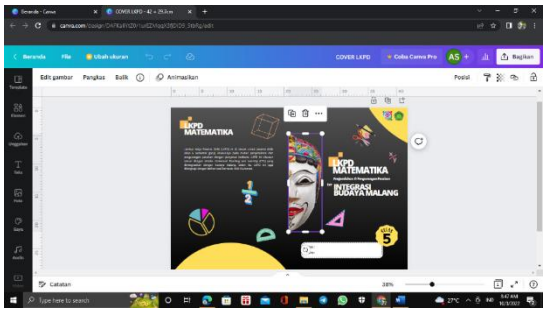

Figure 3. Making covers for student worksheets

6. After that, the cover could be directly saved and downloaded in PDF format and ready to be printed.

7. In addition to product development, there was also a stage of validation activities. Validation was carried out by material experts, media experts, linguists, and learning practitioners. This validation activity used the help of a questionnaire prepared by the researcher. This validation activity was carried out until a valid value was obtained; if the assessment from experts or validators did not meet a valid value, then the product developed must be revised according to the suggestions or directions from the validators.

3.4 Implement

The implementation phase is carried out after the developed media has gone through the validation stage conducted by several validators. The validation results obtained from the validator were then analyzed based on the results of the material expert validator, media expert, linguist, and learning practitioner; the percentages obtained were 84.70%, 80%, 93.33%, and 97,5%. Thus, student worksheets developed by researchers show valid criteria and do not need to be revised. Then, the worksheet product for mathematics students was feasible to use.

The field trial activity for student worksheet products was carried out by 24 students of VA class of MIS Miftahul Huda Jabung Malang. Before the trial, the researcher communicated with the class teacher to determine the student's ability in daily tests on the addition and subtraction of fractions with different denominators. The test scores were used as the initial benchmark or pre-test. This trial activity began with the teacher opening with greetings and continued with a prayer led by the head of the class. After that, the teacher also gave a stimulus to students about the concept of fractions and continued with addition and subtraction questions of fractions with different denominators. Then the teacher explained the systematics of learning and assisted students in teaching and learning with contextual teaching and learning syntax using integrated Malang culture student worksheets developed by researchers. At that time, the teacher could observe the attitude of students.

After the trial activities, students worked on evaluation questions individually to find out the results of their understanding after using the student worksheet products in learning mathematics. The value of the results of working on the evaluation questions would be analyzed and used as post-test scores.

3.5 Evaluate

The evaluation stage served as the phase in which the researchers assessed the overall quality and feasibility of the developed product. This involved a comprehensive review of each stage of the development process. At this point, the researchers analyzed various forms of data, including expert validation results, student response questionnaires, pre-test and post-test scores, as well as comments and suggestions from relevant stakeholders.

The analysis revealed that the validity percentages for all components of the product exceeded 60%, indicating that the student worksheet met the established criteria for validity. Based on these results, the worksheet was deemed valid and appropriate for classroom implementation, with no need for further revision. Therefore, the CTL-based student worksheet, which is integrated with Malang cultural elements, was concluded to be feasible and effective for supporting student learning, particularly in mastering the topic of addition and subtraction of fractions with different denominators.

Discussion

One form of effective visual learning media is the student worksheet. According to Eliati (2020), the use of worksheets in learning environments can foster active student participation, stimulate engagement during lessons, and introduce instructional variety, thus preventing boredom. In this study, the development of student worksheets aimed to address the observed low learning outcomes among students, particularly in the topic of addition and subtraction of fractions with different denominators. To enhance contextual relevance, the worksheets were integrated with elements of local Malang culture, specifically in the context of agricultural practices and traditional foods. The integration of local culture aimed to help students better relate to mathematical concepts through real-life contexts. This aligns with Nasirudin, Rahmawati, and Suyitno (2019), who asserted that contextual teaching significantly influences student achievement in mathematics and serves as an innovative instructional model.

Based on validation results from a team of experts, the developed worksheet achieved high validity scores: 84.70% from material experts (very valid), 80% from media experts (valid), 93.33% from language experts (very valid), and 97.5% from learning practitioners (very valid). According to standard validity criteria, these results confirm that the worksheet is highly valid and suitable for classroom use.

In terms of effectiveness, there was a notable increase in student learning outcomes. The average pre-test score was 86.04, while the post-test score rose to 92.70, indicating a positive impact on students' understanding of fractional operations. These findings are consistent with Agustina (2019), who reported that contextual worksheets improved student learning outcomes—her study showed post-test averages of 85.9 in the experimental group compared to 77.5 in the control group.

Further support comes from Aswarliansyah (2020), who found that contextually-based worksheets increased student activity and motivation, with a learning response-to-outcome correlation of 0.766 (effective) and a practicality score of 89.91%, indicating high usability. Similarly, Prayogo (2021) demonstrated the effectiveness of CTL-based math modules, with an 80.95% mastery rate and an improvement in test scores from 60.00 to 87.6, affirming the potential of contextual media to enhance learning outcomes.

During the design stage, the researchers developed the worksheet by aligning content with core competencies, essential competencies, learning objectives, and indicators. The design was created using the Canva application, which was chosen for its user-friendly interface, visual appeal, and colorful design elements. Although Canva requires a stable internet connection, it has been shown to enhance student engagement. According to Purba (2022), Canva supports creativity and reduces boredom in learning. In fact, 90% of respondents in her study found Canva-based learning "very useful," while 10% found it "useful."

In the development stage, the initial product design was realized and subjected to a validation process involving material experts, media experts, linguists, and learning practitioners. Experts provided suggestions such as incorporating a review of prerequisite materials, offering detailed explanations of fraction operations, using imperative instructions, and including well-structured mathematical problems. This is supported by Yuniarti (2016), who emphasized that mathematical ability helps students express ideas clearly, logically, and concisely.

The implementation stage involved testing the validated worksheets with fifth-grade students at MIS Miftahul Huda Jabung, Malang. The implementation aimed to gather student responses and observe engagement levels. Students showed positive behavioral changes, becoming more active and participative. The integration of colorful visuals, relevant contexts, and varied question types made mathematics learning more enjoyable and effective. These findings align with Nareswari (2021), who argued that CTL-based worksheets support the construction of student knowledge, enhance comprehension of abstract concepts, and facilitate more interactive instruction.

Media Development and Design Analysis

This research and development project aimed to create a student worksheet (LKS) as a form of contextual learning media to support fifth-grade students at MIS Miftahul Huda Jabung Malang in mastering the mathematical concepts of addition and subtraction of fractions with different denominators. The worksheet was intentionally designed to increase student motivation and engagement in mathematics by incorporating the principles of Contextual Teaching and Learning (CTL) and integrating aspects of local Malang culture.

One of the worksheet's notable features is its visually appealing design, which utilizes bright colors and supporting illustrations. This choice was made to attract students' attention and improve their comprehension of mathematical material. As noted by Sujarwo and Oktaviana (2017), color plays a significant role in enhancing students' cognitive processes during learning. Additionally, the worksheet is adaptable for both in-class and independent learning, making it suitable for diverse instructional contexts, particularly in the current educational landscape that encourages flexibility.

The student worksheet also functions as an interactive learning tool that promotes active student participation. Aligned with CTL components such as the learning community, it encourages learners not only to observe and listen but also to engage directly through problem-solving tasks. Furthermore, the worksheet includes examples of Minimum Competency Assessment (AKM)-type questions, providing students with early exposure to real-world numeracy tasks embedded in cultural contexts. From the teacher's perspective, the worksheet simplifies lesson delivery and assessment activities, supporting various evaluation formats such as quizzes, assignments, and summative tests. Importantly, it allows teachers to contextualize mathematics instruction by connecting it to the students' everyday experiences through local cultural content.

Analysis of Product Strengths and Weaknesses

During the implementation phase, students demonstrated increased engagement and enthusiasm. Observations revealed clear behavioral improvements before and after using the worksheet. Students became more participative and motivated, which had a positive impact on their learning outcomes. The integration of local culture into the worksheet contributed significantly to these outcomes by offering a familiar and relatable context for abstract mathematical concepts. This cultural relevance aligns with national education policies that encourage contextual learning and the use of socio-cultural themes in curriculum delivery, especially in preparing students for the AKM.

In addition to its contextual integration, the worksheet featured colorful illustrations and accessible language, which helped students better understand and retain the material. The increase in students' post-test scores and their more active classroom participation further support the

worksheet's effectiveness in enhancing mathematics learning, particularly in the topic of fraction operations.

Despite these strengths, the development process also encountered several challenges. The visual layout of the worksheet, including the cover design, was relatively simple due to the researchers' limited expertise in graphic design. The use of Canva, while user-friendly, required a stable internet connection, and access issues arose in areas with weaker connectivity. Another limitation was the time required to implement the CTL-based worksheet effectively. Given that CTL involves seven stages—constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment—teachers must be well-prepared and have a strong understanding of their students' needs to execute the learning process optimally.

These limitations provide valuable insights for future research and development. Enhancing design quality through more advanced tools, addressing technological constraints, and offering teacher training on CTL implementation could further improve the usability and impact of similar instructional materials.

4. CONCLUSION

Based on the results of this study, the development of a student worksheet based on Contextual Teaching and Learning (CTL) integrated with Malang culture, using the ADDIE development model, has proven to be a valid and feasible learning resource for supporting fifth-grade mathematics instruction at MIS Miftahul Huda Jabung Malang. The worksheet effectively facilitated student understanding of addition and subtraction of fractions with different denominators by incorporating cultural elements and interactive, student-centered activities. Validation from experts and positive responses from both teachers and students indicated that the product met the necessary standards for classroom use. However, one limitation of the research lies in the simplicity of the worksheet's design, particularly the cover and visual layout, which were constrained by the developers' limited design experience. As such, future research is encouraged to enhance the visual quality of the media by utilizing professional design tools such as Adobe Illustrator, Adobe Photoshop, or CorelDRAW to create more engaging and visually diverse materials. Additionally, further studies could explore the long-term impact of CTL-based cultural integration on student achievement and engagement across broader mathematical topics and different educational contexts.

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