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Development of student worksheets in natural and social sciences based on culturally responsive teaching for fifth grade elementary students

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Abstract
This study aims to determine the development and feasibility of student worksheets in natural and social sciences based on culturally responsive teaching for fifth grade elementary school students. This study is a development study using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. The research subjects were media experts, subject matter experts, teachers, and students. The research instruments were interviews, observations, needs analysis questionnaires, validation questionnaires, and teacher and student response questionnaires. Data analysis techniques used descriptive analysis. The results of the study indicate that worksheet products based on culturally responsive teaching are feasible and practical as teaching materials to support the learning process. Feasibility based on the results of subject matter expert validation obtained a total score of 96 in the very feasible category, while the results of media expert validation obtained a total score of 98 in the very feasible category. Practicality based on teacher response questionnaires and student response questionnaires was in the very practical category.
Keywords: Teaching materials; culturally responsive teaching; student worksheets; natural and social sciences

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INTRODUCTION

Education in the 21st century emphasizes the importance of students being able to process information obtained through learning activities that involve analyzing, evaluating, and creating. To achieve this, students need to master various skills such as creative thinking, communication, critical thinking, problem-solving, and collaboration(Orhan Özen, 2022; Prachagool & Nuangchalerm, 2021; Xu & Zhou, 2022). These skills can be optimized through social studies education. In Indonesia's *Kurikulum Merdeka* (Independent Curriculum) at the elementary level, social studies are integrated with natural science into a subject called natural and social sciences, taught in Phase B (3rd-4th grades) and Phase C (5th-6th grades). Specifically, the achievement of the social studies concentration natural and social sciences element states that

students can identify economic and creative economic activities in their environment and are able to take action and be sensitive to local and cultural potential. This is in line with the opinion of experts who state that IPS learning can equip students to carry out their roles as citizens equipped with 21st century life skills (Dewanti & Putra, 2022). Therefore, culture-based learning integrated with social studies learning can enrich students' learning experiences not only conceptually but also by integrating local cultural elements with material relevant to students' lives. Through social studies learning, efforts can be made to preserve students' cultural identity (Rahmawati et al., 2020).

In reality, natural and social sciences learning—particularly the social studies aspect—has not yet fully integrated local wisdom and culture. Teachers tend to rely on the standard student textbook and third-party printed worksheets for instruction. Physically, these worksheets are printed on low-quality A4 paper, dominated by black-and-white text and images, making them less attractive to students. Substantively, the worksheets contain narrative text, a few black-and-white illustrative images, and sets of questions that students must answer. This situation is confirmed by a needs analysis survey of Grade V teachers and 101 students: 86% of student responses indicated a need for new teaching materials that integrate subject content with the students' cultural background. One potential solution to address this need is to employ a culturally responsive teaching approach in developing instructional materials.

Culturally responsive teaching (CRT) is a pedagogical approach that leverages students' cultural knowledge, life experiences, and diverse ethnic backgrounds to make learning more effective and relevant (Gay, 2013). This approach recognizes and incorporates students' cultural references in all aspects of learning (Rahmawati et al., 2020). For teachers, CRT offers the benefit of understanding the relationship between the diverse needs of the student population and the teaching process, enabling them to respond to differences in students' cultural background, language, socioeconomic status, race/ethnicity, and religion (Iwai, 2019; Tanase, 2022). For students, CRT optimizes the use of their cultural knowledge and experiences as tools for learning (Cowden et al., 2021). Culturally responsive learning provides a conducive learning environment for students to have respectful relationships, increase a sense of belonging, learn more meaningfully, and have an impact on learning outcomes (Dickson et al., 2016). Culturally responsive learning can be implemented in the social studies learning process using teaching materials in the form of student worksheets.

Natural and social sciences worksheet-based CRT is a culturally responsive student worksheet. It refers to pedagogy that combines cultural references into learning that is more meaningful and effective for students from diverse backgrounds (Schirmer & Lockman, 2022). CRT is in line with researchers' findings in the field that schools have implemented diagnostic assessments before teachers develop lessons so that they can be used as a basis for designing lessons tailored to students' needs. The results show that students have different backgrounds and that some students come from outside Java. This information poses a challenge for teachers in design learning (Rahmawati et al., 2020). CRT aims to optimize students' academic outcomes and cultural potential so that students can maintain and strengthen their cultural identity and encourage critical thinking and problem-solving skills in relation to their current cultural conditions. Cultural context and local content can be sources of learning contained in students' reading texts. This is in line with (Hardianto et al., 2023), who stated that reading materials containing cultural themes are expected to increase students' understanding of the cultural diversity in Indonesia.

Worksheet-based CRT has several advantages, including: the material presented is integrated with the students' culture, accommodating differences in students' backgrounds such as social, cultural, economic, and linguistic status so that students can recognize their own culture (Bjarnason, 2023). It helps teachers manage time, improve students' knowledge and skills, and helps students recognize and appreciate their cultural identities (Lee, 2014). The development of new worksheet based on CRT has been positively received by teachers and students.

METHODS

This research is a development study utilizing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) as the framework (Branch, 2009). The study was conducted in Kulon Progo Regency, specifically in the Temon sub-district of Yogyakarta Special Region. The subjects in this study were one subject matter expert (content expert), one media expert, a fifth-grade teacher, and fifth-grade students. Data collection instruments included expert validation questionnaires (for media and material), teacher and student response questionnaires, interview guides, observation sheets, and a needs analysis questionnaire for the worksheet. The development procedure using the ADDIE model is depicted in Figure 1, which outlines the five phases of development.

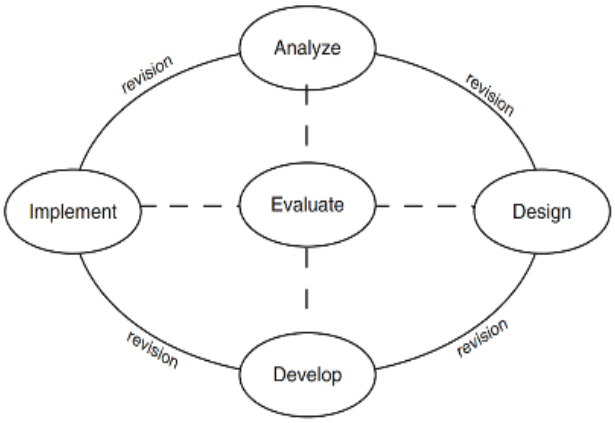

Figure 1. ADDIE development model

Data from observations, interviews, and the needs analysis questionnaire were analyzed descriptively to determine the requirements for the worksheet. Data from the expert validation questionnaires (media and material experts) were analyzed to determine the feasibility of the developed media, and data from the teacher and student response questionnaires were analyzed to determine the practicality of the developed media. In the user trials involving students and the teacher, the implementation was carried out in three stages: a one-to-one trial (6 students and 1 teacher), a small group trial (12 students and 1 teacher), and a field trial (20 students and 1 teacher). All assessment items used a 4-point rating scale (1 to 4). The data analysis technique used to determine the feasibility and practicality of using the formula is as follows.

$$P = \frac{\sum X}{N} \times 100\%$$, with P = percentage score; x = score; N = maximum score

The quantitative scores from validations and trials were converted into qualitative categories using the criteria in Table 1 and Table 2. Average scores were calculated for each assessment, then each average was converted to a percentage and classified according to the categories in the tables below.

Table 1. Feasibility category (Score to category conversion)

Score (%)	Feasibility Category
<21%	Very Infeasible
21% < Value ≤ 40%	Not Feasible
41% < Value ≤ 60%	Moderately Feasible
61% < Value ≤ 80%	Feasible
81% < Value < 100%	Very Feasible

Table 2. Practicality category (Score to category conversion)

Score (%)	Practicality Category
85,01 - 100%	Very Practical
75,01 - 85%	Practical
60,015 - 75,00%	Moderately Practical
50,01 - 60,00%	Less Practical
<50,00%	Very Impractical

RESULTS AND DISCUSSION

Results

The outcome of this development research is a CRT-based natural and social sciences worksheet focusing on the material from Grade V Theme 7, "*Daerahku Kebanggaanku*" ("My Region, My Pride"). The worksheet was developed through the five ADDIE stages (analyze, design, develop, implement, evaluate), and the final product was deemed valid and practical for classroom use. The following is a description of each development stage and the characteristics of the resulting product.

The first stage is Analyze. The analysis stage aims to identify problems that occur in the learning process. The research activity began with observation and interviews, as well as distributing questionnaires to fifth-grade teachers and students. Based on this research, it was found that learning still uses learning resources that do not facilitate students' learning styles and cultural diversity.

The second stage is the Design stage, which is to design natural and social sciences worksheets based on CRT. The worksheet design process begins with planning by identifying learning outcomes and learning objectives based on the curriculum used. This is followed by determining the material and searching for supporting material references. The application used in designing the natural and social sciences worksheet was Canva, assisted by Corel Draw, and the supporting components of the worksheet, such as images, text, and learning materials, were identified. The natural and social sciences worksheet was equipped with images and reading texts relevant to the daily lives of students in Kapanewon Temon. The images and photos contained were the researcher's personal property to support culturally responsive teaching-based learning. The learning outcomes were selected based on the Grade 5 Teacher's Book of the independent curriculum. The independent curriculum contains the Pancasila Student Profile to be developed by students. In this study, the Pancasila student profile to be implemented is Faithful, devoted to God Almighty and noble in character; Globally diverse; Critical thinking; Creative; and Cooperative.

The third stage of development is to design the product to be developed. The procedure for developing worksheet is to prepare applications such as Canva and Corel Draw as well as supporting components for worksheet such as images, text, and learning materials. Next, product validation is carried out in the form of media expert and material expert validation. This stage aims to determine the feasibility of CRT-based worksheet and to obtain suggestions and input on the developed product. After being declared feasible, the worksheet is tested by fifth-grade teachers and students, divided into one-to-one trials, small group trials, and field trials.

The cover page of the developed worksheet contains the title of the worksheet along with images and supporting components based on CRT that contain and highlight Kapanewon Temon, Kulon Progo Regency, D I Yogyakarta. The learning activities contain three learning topics, namely topic A: What is my regional culture like? which contains the main material on acculturation and culture around residence, including identifying cultural heritage and the history of cultural heritage around residence. Topic B: The Economic Conditions in My Region contains material on economic conditions, including economic activities, key economic activities in the region, and ways to improve the economy in the region. And Topic C: Wow, My Region is Amazing contains core material on leading products in the region, including identifying leading products in the region, factors supporting leading products, and how to design and introduce a leading product. natural and social sciences worksheet based on CRT emphasizes culture-responsive learning so

that students are trained to respond and solve problems. The worksheets in each learning activity begins with inviting sentences such as “Let's Identify,” “Did You Know,” “Let's Give Your Response,” “Let's Read,” “Let's Explore,” “My Character,” “Let's Conclude.” It is equipped with a journal of love for the homeland, reflections, a glossary, and reference sources. The following are the worksheets based on CRT that have been developed.

Figure 2. Cover of the developed worksheet

The cover displays the worksheet identity, including the title, author, and target audience. The cover was created using the Canva application. The fonts used are Muli and ITC Motter Corpus Semico. The worksheet cover is dominated by green colors and a *Geblek Renteng* motif, which is the icon of Kulon Progo Regency. The *Geblek Renteng* motif was chosen to support CRT. In addition, it is equipped with several images, such as the emblem of Yogyakarta State University.

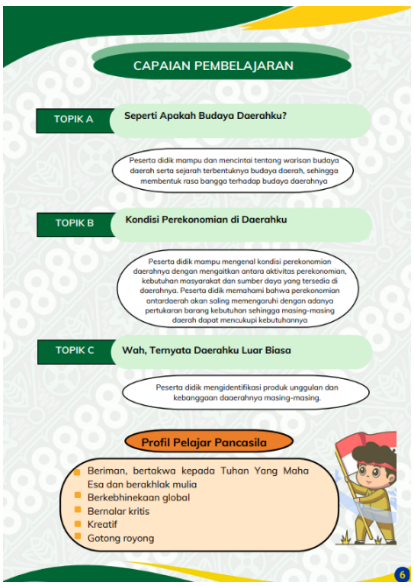

Figure 3. Learning outcomes page of the worksheet

The learning outcomes display contains the learning outcomes for each topic as well as the Pancasila student profile, which contains 5 profiles to be studied by students.

Figure 4. Example content page from the worksheet

The worksheet display contains material to be studied by students. It begins with the title of the learning topic, appreciation, learning objectives, and interaction with users regarding students' knowledge of the material topic to be studied.

The implementation stage of the developed worksheet product is then followed by product validation by media experts and subject matter experts (M. Rahmawati et al., 2023). Expert validation aims to determine the feasibility of the initial product by lecturers who are experts in the relevant material and media. After being validated by experts and revised according to their suggestions, input, and directions, and the product is declared feasible for testing without revision, it is then tested by teachers and students to determine the practicality of the developed worksheet. The following is a description of the results of the worksheet product validation.

Table 3. Summary of worksheets validation and trial results

No	Evaluator/Respondent	Score (%)	Category
1	Media Expert (Learning Media)	80 %	Very Feasible
2	Subject Matter Expert (Content)	98 %	Very Feasible
3	Teacher Response – One-to-One Trial	98%	Very Practical
4	Student Response – One-to-One Trial	91%	Very Practical
5	Teacher Response – Small Group Trial	95%	Very Practical
6	Student Response – Small Group Trial	91%	Very Practical
7	Teacher Response – Field Trial	94%	Very Practical
8	Student Response – Field Trial	93.3 %	Very Practical

The evaluation stage is the final stage of the entire ADDIE development model. The evaluation of the natural and social sciences worksheet based on CRT was carried out in stages and at each step of development to improve the quality of the instrument. Evaluation was carried out continuously to minimize errors so that they could be corrected immediately. The evaluation was based on input, suggestions, and analysis from experts and implementation. Based on the results of the development carried out at each stage, the natural and social sciences worksheet product based on CRT is declared feasible and practical for use.

Discussion

The first stage of definition was carried out through needs analysis, observation, and interviews. These activities aim to ensure that the products developed can truly address problems in the field. Based on direct observations in the field, during the learning process in the classroom, students lack focus in paying attention to the teacher's explanations, the use of student worksheets used by teachers dominates learning, learning that minimizes the integration of local culture, and students who lack understanding of the culture around them. Students had difficulty answering questions about the local content and culture around their place of residence and its history. For example, the closest local potential used by students was batik in the form of geblek renteng batik. This batik is used every Thursday throughout the institutions in Kulon Progo Regency. However, students did not understand the history of geblek renteng batik. The results of observations and interviews were reinforced by the results of a needs analysis questionnaire given to fifth-grade elementary school students in Kapanewon Temon. The results showed that 86% of the students' answers indicated a need for new teaching materials that could integrate the material with the students' cultural background. Experts argue that cultural aspects play an important role in supporting a more meaningful learning process (Murti, 2023).

The CRT-based natural and social sciences worksheet developed in this study is designed to facilitate students' learning potential by accommodating different learning styles and paces while linking the material to the students' own culture and local environment (Kapanewon Temon area). The content of the worksheet includes topics on cultural heritage, economic activities, and local superior products, which are all relevant to the students' lives. The worksheet is presented in an attractive format that leverages local potential and engages students in problem-solving activities that also foster love for their region and country. Because the worksheet is in printed module form, it can be used by students either independently or in groups, which can increase interaction and collaboration among students as well as between students and the teacher. As supporting teaching material, a worksheet helps train students' skills and guides their learning (Purwasi & Fitriyana, 2020). The use of worksheets has been found to create a conducive learning atmosphere, optimize interactions between teacher and students, and present a series of tasks that guide students to discover concepts and gain problem-solving experience (Widodo et al., 2023). Furthermore, worksheets can encourage students to learn both independently and collaboratively under the teacher's guidance through challenging activities, which in turn positively impacts learning outcomes (Gustiningsi et al., 2022). Therefore, the use of worksheet facilitates the learning process, enhances effective interaction and student activity, and improves learning outcomes (Ranti & Usmeldi, 2019).

As a subject requires students to learn about natural conditions and social phenomena in their surrounding environment. This inherently requires students to solve problems and be sensitive to everyday real-life situations. One important character value that emerges from this sensitivity to one's environment is patriotism (love of homeland). Patriotism is reflected in behaviors of care and responsiveness to one's physical, social, cultural, and economic environment (Koerniawati, 2023). By integrating local environmental and cultural content into the natural and social sciences worksheet through a culturally responsive approach, this development addresses the diverse needs of students and helps insert their cultural identities into the learning process. Such an approach allows students to bring in their own cultural background—ethnicity, language, traditions—into their learning, helping them recognize and appreciate both their own culture and that of others (Kotluk & Kocakaya, 2020). In this way, the CRT-based worksheet not only teaches academic content but also validates and utilizes students' cultural knowledge, thereby meeting a key need in multicultural classrooms.

Teachers and students responded positively to the natural and social sciences worksheet based on CRT. This was evident in the students' enthusiasm and active involvement in learning. The material contained readings and illustrations that supported culturally responsive learning, making it relevant to the students' lives. Students who already had knowledge and experience related to culture were able to support the learning process (Cowden

et al., 2021). Culturally responsive learning provides a conducive learning environment where students not only gain an understanding of the material but also learn respect and a sense of belonging (Dickson et al., 2016). Furthermore, teachers say that culturally responsive learning encourages students to actively participate, which has an impact on learning outcomes. On the other hand, culturally responsive learning can improve the learning outcomes and academic achievement of diverse students (Gay, 2002).

CONCLUSION

The development of natural and social sciences worksheet based on CRT has met the eligibility criteria as supporting teaching materials in the learning process, especially in social studies subjects in the Merdeka Curriculum. Based on the results of material validation, the worksheet was declared eligible with a total score of 96 and a percentage of 80%, which is included in the "Very Eligible" category. In addition, the results of the media aspect validation also showed the "Highly Eligible" category with a score of 98 and a percentage of 98%. In terms of practicality, the natural and social sciences worksheet based on CRT was also considered to meet the standards as practical teaching materials based on user responses, namely teachers and students. In the one-to-one trial phase involving fifth-grade teachers at SDN Temon Kulon, a total score of 95 with a percentage of 98% was obtained, which was categorized as "Very Practical." Meanwhile, the responses from 12 fifth-grade students showed a total score of 547 with a percentage of 91%, which was also categorized as "Very Practical." In the small group trial stage, the teachers' responses obtained a total score of 95 with a percentage of 95% and were included in the "Very Practical" category. The responses of 12 fifth-grade students at SDN Kebonrejo showed a total score of 1101 with a percentage of 91%, which was also classified as "Very Practical". Furthermore, in the field trial stage, teachers gave a total score of 94 with a percentage of 94% in the "Very Practical" category, while the responses of 20 fifth-grade students at SDN Kalisari obtained a total score of 1866 with a percentage of 93.3%, which was also classified in the "Very Practical" category. In summary, the natural and social sciences student worksheet developed with a CRT approach has been proven feasible in terms of content and design and practical in terms of classroom implementation. It can be used as an effective teaching aid to support the learning process, helping to integrate local cultural context into natural and social sciences learning and improve student engagement and learning outcomes

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