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# Development of Culturally Responsive Teaching Self-Efficacy (CRTSE) Scale in Mathematics Learning at Junior High Schools

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**ABSTRACT**

This study aimed to develop and validate a *Culturally Responsive Teaching Self-Efficacy (CRTSE)* scale and a culturally integrated mathematics teaching module for junior high schools in Banjar City, Indonesia. Culturally responsive teaching (CRT) supports inclusive and contextual learning by integrating students' cultural backgrounds into instruction—an approach underutilized in Indonesian mathematics education. Using the ADDIE development model within a Research and Development (R&D) framework, the study involved 350 seventh-grade students and 10 mathematics teachers across five culturally diverse schools. The CRT-based module focused on quadrilateral concepts contextualized through Banjar's cultural sites. Expert validation rated the module as "very good" (average score: 3.875), and limited trials showed high student approval (93.02% positive response). Large-scale implementation was evaluated through pre- and post-tests using ANCOVA to assess learning gains. Results showed significant improvement ($p < .01$) in students' mathematics achievement in experimental classes compared to control groups. Teachers' CRTSE scores indicated highest self-efficacy in facilitating cooperative learning (40.7%), with moderate confidence in understanding students' cultural backgrounds (33.3%). The findings demonstrate that the culturally integrated module is valid, practical, and effective in enhancing students' mathematical understanding. The CRTSE scale offers a promising tool for assessing teacher readiness to implement CRT in mathematics. These results support the integration of CRT into Indonesia's Merdeka Curriculum to promote equitable and contextual learning.



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## 1. INTRODUCTION

Indonesia is a multicultural country with a diversity of religions, ethnicities, languages, and cultures. This diversity is both a national treasure and a major challenge, because if not managed wisely, it has the potential to cause social conflict (Nugraha et al., 2025). In the world of education, this condition requires teachers to be able to manage heterogeneous classes and organize inclusive learning that is favorable to all students. In response, culturally responsive teaching (CRT) has emerged as a critical pedagogical approach to try to bridge this gap and create a more equitable learning environment for all students (Moore et al., 2025). One relevant approach in this context is Culturally Responsive Teaching (CRT), which is teaching that is responsive to students' cultural backgrounds. CRT is not only oriented towards academic achievement but also towards building tolerance, cross-cultural understanding, and appreciation of differences.

CRT emphasizes the importance of connecting learning with students' identities, languages, and cultural experiences. A culturally responsive teaching approach has emerged as an effective method for increasing student engagement and participation in the classroom, especially among students from diverse cultural and linguistic backgrounds (Moore et al., 2025). Teachers who implement CRT strive to understand the diversity of their students' backgrounds and integrate it into the learning process. This requires teachers to have pedagogical competencies that are sensitive to culture, as well as self-efficacy or self-confidence in their ability to implement inclusive learning fairly and effectively (Moore et al., 2025). However, research on teacher self-efficacy in implementing CRT in Indonesia, especially in mathematics learning, is still limited. In fact, mathematics, which is often viewed as universal and abstract, has great potential to be linked to local culture through real-life contexts that are close to students' lives.

While mathematics is frequently perceived as a universal and culturally neutral discipline, implementing CRT in mathematics requires adaptations that differ substantially from subjects such as language or social studies. In language and social science classrooms, cultural content is inherently embedded in texts, narratives, and social interactions, making cultural integration more intuitive. In contrast, mathematical concepts are often taught in abstract, symbolic forms that appear disconnected from students' lived experiences. Therefore, CRT in mathematics must deliberately contextualize concepts through culturally meaningful examples, ethnomathematical practices, and local community knowledge. Studies in culturally responsive mathematics pedagogy demonstrate that connecting geometric shapes, measurements, patterns, and spatial reasoning to cultural artifacts and local practices can enhance students' conceptual understanding and engagement (Laksana et al., 2021; Barton, 2020; Hendricks et al., 2024). These findings show that mathematics teachers require specialized strategies to integrate culture into instruction, underscoring the importance of developing tools such as CRT self-efficacy measures specifically tailored to the mathematics context

Teachers play an important role in selecting and presenting material objectively, professionally, and impartially so that students can refute negative stereotypes while developing a more tolerant perspective. Thus, education becomes a vehicle for social transformation that shapes a critical, inclusive, and globally-minded generation. Education also plays a central role in the development of civil society, which is characterized by tolerance, independence, legal awareness, and respect for plurality (Saihu et al., 2022). Through education, individuals are encouraged to become people of faith, critical thinkers, creative, democratic, and able to live in diversity. In other words, education that is responsive to cultural diversity not only supports academic achievement but also shapes national character based on the spirit of *Bhinneka Tunggal Ika* (unity in diversity). This is important so that the younger generation can participate in peaceful social life while respecting differences (Saputra et al., 2023).

Indonesia, with more than 1,300 ethnic groups and hundreds of regional languages, faces enormous challenges in managing diversity. Potential conflicts can arise from stereotypes, prejudice, intolerance, and differences in political and economic interests (Utami & Murwani, 2025). Therefore, education must be directed towards strengthening cross-cultural understanding, fostering tolerance,

and developing students' social skills. In this context, CRT is an important strategy that emphasizes four main aspects: cultural awareness, learning partnerships, information processing, and the development of inclusive learning communities (Kieran & Anderson, 2019).

The wealth of cultural sites is proof that the city of Banjar has great potential to integrate cultural aspects into education, especially in school learning. These sites not only serve as historical heritage that must be preserved but can also be used as contextual media in learning, including in mathematics (Laksana et al., 2021). For example, the shapes of buildings, geometric structures, and architectural patterns at cultural sites can be linked to mathematical concepts such as flat shapes, spatial shapes, symmetry, or geometric transformations. Thus, students can learn mathematics through a local culture-based approach that is closer to their lives.

However, integrating local culture into learning is not simple. It requires teachers who not only master the material but also have cultural awareness and self-efficacy to relate culture to teaching materials (Peterson & Jensen, 2025). This is where the urgency of Culturally Responsive Teaching (CRT) becomes relevant. CRT emphasizes learning that is responsive to students' identities, languages, and cultural experiences, making learning more inclusive, meaningful, and promoting tolerance. The urgency of this research is even stronger because teachers, especially mathematics teachers, often consider this subject to be universal and detached from cultural context (Hendricks et al., 2024). As a result, learning tends to be abstract, lacking in context, and difficult for students to understand. The Culturally Responsive Teaching Self-Efficacy (CRTSE) Scale can measure the extent to which teachers believe in integrating local culture into mathematics learning (Zakariya & Adegoke, 2024). This instrument is important as a basis for developing teacher competence, as well as an effort to support the implementation of the Merdeka Curriculum, which places teachers as facilitators in accommodating the cultural diversity of students.

Recent empirical work on culturally responsive pedagogy has begun to address teachers' beliefs and capacities, showing that higher CRT self-efficacy correlates with more frequent use of culturally grounded strategies and improved student engagement (Cruz et al., 2019; Zakariya & Adegoke, 2024). However, most of these studies were conducted in Western or African contexts and emphasize language-arts and social-studies applications rather than mathematics. A smaller but growing body of research in culturally responsive mathematics pedagogy demonstrates that linking mathematical ideas to local practices and artifacts can enhance conceptual understanding and relevance for students (Laksana et al., 2021; Hendricks et al., 2024). Despite these advances, two clear gaps remain: there is no widely validated CRT self-efficacy instrument tailored for Indonesian mathematics teachers, and few studies combine the development of a culturally integrated instructional module with a concurrent, validated measure of teacher CRT self-efficacy. Addressing both gaps simultaneously would provide practical tools for teacher development and stronger evidence about how culturally grounded modules influence both teacher practice and student outcomes.

By linking the cultural sites of Banjar City to mathematics learning through the CRT approach, it is hoped that a more contextual, interactive, and character-building learning atmosphere will be created. In addition to improving understanding of mathematical concepts, this strategy also fosters students' awareness of the importance of preserving local culture (Cruz et al., 2019). Research on the development of the CRTSE Scale is urgently needed so that a valid and reliable instrument is available to measure teacher self-efficacy, which can then be used as a basis for designing training programs and improving teacher capacity in culture-based learning.

The urgency of implementing CRT is further reinforced by the results of previous studies. (Salma & Yuli, 2023) emphasize that the Merdeka Curriculum provides ample opportunity for teachers to act as facilitators who accommodate the diversity of students' backgrounds. Meanwhile, research (Kurniawan et al., 2024) shows that junior high school students in Banjar City come from diverse cultural backgrounds, including Sundanese, Javanese, Batak, Minang, and Chinese ethnicities, and use a variety of languages in their daily communication. This condition requires a mathematics learning

strategy that is able to integrate local culture to be more contextual, meaningful, and in line with the students' characteristics.

The theoretical foundation of this study draws upon three major frameworks. First, Bandura's self-efficacy theory posits that individuals' confidence in performing a task is shaped by four sources—mastery experiences, vicarious experiences, verbal persuasion, and physiological states—which influence motivation, resilience, and instructional decisions (Bandura, 1997). Applied to teaching, CRT self-efficacy reflects teachers' beliefs in their ability to enact culturally responsive strategies in diverse classrooms. Second, CRT theory, as articulated by Gay (2018) and further developed by Hammond (2015), emphasizes cultural awareness, learning partnerships, information processing, and the creation of inclusive classroom communities as core dimensions of culturally responsive pedagogy. These dimensions guide how teachers integrate students' cultural identities, experiences, and communication styles into instruction. Third, culturally responsive mathematics pedagogy highlights that mathematics, often viewed as abstract and culture-neutral, requires deliberate contextualization through local cultural artifacts, ethnomathematical practices, and real-world applications to make learning meaningful and accessible (Hendricks et al., 2024; Laksana et al., 2021). Together, these theoretical perspectives inform the design of the CRTSE scale and the development of the culturally integrated mathematics module in this study, ensuring alignment between pedagogical theory, measurement, and instructional practice

Based on this description, this study aims to develop a Culturally Responsive Teaching Self-Efficacy (CRTSE) Scale instrument that is relevant to the context of mathematics learning in junior high schools in Banjar City. The resulting product is expected to have validity, reliability, and suitability with the local culture, so that it can be used to measure the extent of teachers' confidence in implementing culturally responsive mathematics learning. Thus, this study not only contributes to the development of scientific instruments but also supports efforts to strengthen inclusive, tolerant, and contextual education in Indonesia.

## 2. METHODS

This study uses the Research and Development (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. This model was chosen because it is systematic, structured, and suitable for producing learning products that are valid, practical, and effective for use in the classroom. The study was conducted in five junior high schools in Banjar City, which were selected using purposive sampling based on the following criteria: (1) schools representing different subdistricts, (2) schools with culturally diverse student populations, and (3) schools with at least two parallel Grade VII classes that allowed for experimental and control group comparisons. Within each selected school, classes were assigned to either the experimental or control condition using intact class assignment (non-randomized), as schools did not permit random reassignment of students. Each Grade VII class consisted of approximately 34–36 students, resulting in a total sample of about 350 students across the five schools. The demographic composition of students reflected the multicultural context of Banjar City, including Sundanese, Javanese, Batak, Minang, Sumatran, and Chinese ethnic backgrounds. Both male and female students were included, with relatively balanced proportions across classes. Ten mathematics teachers (two per school) participated in the administration of the Culturally Responsive Teaching Self-Efficacy (CRTSE) scale

**Table 1.** Sample Characteristics of Schools, Classes, and Participants

| School | Class (Experimental) | Class (Control) | Students per Class | Estimated Total Students | Gender Distribution* | Cultural/Ethnic Composition* |
|---|---|---|---|---|---|---|
| SMPN 1 | VII G | VII F | 35–36 | ~70 | Balanced (M/F) | Sundanese, Javanese, Batak, Minang |
| SMPN 2 | VII A | VII B | 34–35 | ~69 | Balanced | Sundanese, Sumatran, Chinese |
| SMPN 6 | VII A | VII B | 34–36 | ~70 | Balanced | Sundanese, Javanese |
| SMPN 8 | VII A | VII B | 34–36 | ~70 | Balanced | Sundanese, Minang, Chinese |
| SMPN 9 | VII A | VII B | 34–35 | ~69 | Balanced | Sundanese, Batak, Javanese |

1. Analysis Stage (Analysis)
   At this stage, needs were identified through analysis of the curriculum, student characteristics, learning materials, and problems that arise in mathematics learning. The results of the analysis showed that junior high school students in Banjar City have diverse cultural backgrounds (Sunda, Javanese, Batak, Minang, Sumatran, and Chinese). This condition requires innovation in mathematics learning that is able to integrate local cultural diversity so that learning is more meaningful and contextual.
2. Design Stage
   Based on the results of the analysis, the design stage focused on the preparation of a mathematics teaching module with material on quadrilateral shapes. This module is designed by integrating cultural sites in Banjar City as a learning context, so that students can relate mathematical concepts to their surrounding cultural environment. In addition, this stage also includes the preparation of a lesson plan, a CRTSE questionnaire grid, and learning evaluation tools.
3. Development Stage
   In the development stage, the teaching module design that had been compiled was realized into a tangible product. The teaching module was then validated by two content experts, namely Mathematics Education lecturers, to assess the feasibility of the material, its integration with local culture, and its suitability with the principles of Culturally Responsive Teaching. The validation results were used to make revisions so that the developed module would be of better quality.
4. Implementation Stage The implementation stage was carried out in two trial scales, namely:
   a) Limited trial, conducted at SMPN 8 Banjar involving 10 seventh-grade students. This trial aimed to obtain an initial overview of the module's readability, practicality, and student response.
   b) Extensive trial, conducted in five schools, namely SMPN 1, SMPN 2, SMPN 6, SMPN 8, and SMPN 9 in Banjar City. At this stage, the teaching module was applied in the experimental class, while the control class used conventional learning. The effectiveness of the product was tested by comparing student learning outcomes using test instruments (pre-test and post-test).

5. Evaluation Stage
   Evaluations were conducted formatively and summatively at each stage of development. Formative evaluations aimed to provide feedback for product improvement, while summative evaluations assessed the overall effectiveness of the product after implementation. Thus, each stage of ADDIE was interrelated and provided input to improve product quality.

The Culturally Responsive Teaching Self-Efficacy (CRTSE) scale was developed using a systematic process. First, 35 items were created based on a review of previous studies on culturally responsive teaching and self-efficacy (Gay, 2018; Hammond, 2015; Cruz et al., 2019; Zakariya & Adegoke, 2024) and Bandura's four sources of self-efficacy. The items covered key aspects of culturally responsive teaching, such as cultural awareness, instructional strategies, learning partnerships, and classroom climate management. Three experts in mathematics education and multicultural education then reviewed the items to ensure they were clear, relevant, and culturally appropriate.

The instruments used in this study included the CRTSE questionnaire to measure teachers' self-efficacy in applying culturally responsive teaching, expert validation sheets to evaluate the quality of the teaching modules in terms of content, language, and design, and mathematics achievement tests (pre-test and post-test) to measure students' learning outcomes. The data were analyzed using descriptive and quantitative methods. Expert validation results were calculated using average scores to determine the feasibility of the module, student responses were analyzed using percentages to assess practicality and acceptance, and the effectiveness of the module was tested using Analysis of Covariance (ANCOVA) to compare post-test scores between the experimental and control classes while controlling for pre-test differences. All statistical analyses, including descriptive statistics, validity and reliability tests, and ANCOVA, were conducted using IBM SPSS.

## 3. FINDINGS AND DISCUSSION

This study was conducted in grade VII at SMPN 1, SMPN 2, SMPN 6, SMPN 8, and SMPN 9 in Banjar City. The development of this interactive learning media was carried out using the ADDIE development model, which consists of five stages of development, namely: (1) analysis stage, (2) design stage, (3) development stage, (4) implementation stage, and (5) evaluation stage.

### *3.1 Analysis stage*

The analysis of students was conducted through unstructured interviews with mathematics teachers at junior high schools in Banjar City. The interviews revealed that the students came from diverse cultural backgrounds, including Chinese, Minang, Sumatran, Sundanese, Javanese, and Batak ethnicities. In their daily activities, they communicate using Indonesian and Sundanese, in accordance with the majority of the population there, which is Javanese and Sundanese. The data on junior high schools in Banjar City is as follows:

**Table 1. Data on Junior High Schools in Banjar City**

| School Type | Experimental Class | Control Class |
|---|---|---|
| SMPN 1 Banjar | VII G | VII F |
| SMPN 2 Banjar | VII A | VII B |
| SMPN 6 Banjar | VII A | VII B |
| SMPN 8 Banjar | VII A | VII B |
| SMPN 9 Banjar | VII A | VII B |

### *3.2 Design Stage*

This stage aims to prepare and design teaching modules according to the needs based on the information from the previous stage, namely the analysis stage. Some of the things designed in the design stage include reviewing the learning outcomes and objectives of the rectangular flat shape material, determining the material and questions with a cultural background that are tailored to the learning objectives, and designing teaching modules by integrating local culture, in this case using buildings/cultural sites around the city of Banjar.


**Figure 2.** Teaching Module Design

### *3.3 Development Stage*

At this stage, we continue from the previous stage by creating teaching modules in physical form according to the design that has been made. In developing the modules, we integrate cultural sites in the city of Banjar and mathematical material on quadrilateral shapes. During the development stage, the modules are also validated by validators to determine the feasibility of the teaching modules being developed.

#### 3.3.1 Expert Validation

The teaching modules developed in this study were then validated by content experts to ensure the suitability of the product before it was implemented with students. The validation process involved two lecturers from the Mathematics Education Study Program, FKIP Siliwangi University, who acted as validators. The instrument used was an assessment questionnaire with a four-category scale, namely "Very Good" (score 4), 'Good' (score 3), "Not Good" (score 2), and "Very Not Good" (score 1). The aspects assessed included the suitability of the material content, integration with the local cultural context, clarity of language, and the suitability of the module's appearance with the principles of culturally responsive learning.

**Table 2.** Results of Expert Validation of the Culturally Responsive Teaching Module

| No | Assesment Aspects | Validator Score | |
|---|---|---|---|
| 1 | Material suitability with the curriculum | 4 | |
| 2 | Accuracy of local cultural integration | 4 | |
| 3 | Clarity of language | 4 | |
| 4 | Intermaterial integration | 4 | |
| 5 | Accuracy of illustrations and examples | 3 | |
| 6 | Readability of the module for students | 4 | |
| 7 | Appearance of the module | 4 | |
| 8 | Support for learning objectives | 4 | |
| | | Total Score | 31 |
| | | Average | 3.875 |

Based on the results of the two validators' assessments, an average score of 3.875 was obtained. When converted to a four-point scale, this result falls into the "very good" category. Thus, it can be concluded that the Culturally Responsive Teaching (CRT)-based teaching module that was developed is suitable for use as teaching material in mathematics learning. The validation results also indicate that the module content is in line with curriculum requirements, is able to integrate local cultural elements appropriately, and is presented in a communicative language and an attractive format for students.

These findings are in line with the opinion of Domensino et al. (2024), who assert that learning instruments that receive expert validation in the excellent category can be used as a reference for implementation in the classroom. Expert validation serves as an academic quality control mechanism, ensuring that the resulting product is not only innovative but also meets pedagogical standards. Thus, the validation results provide a strong basis for proceeding with the teaching module to the field trial stage, both on a

### *3.3.2 Limited Scale Trial*

The validation stage was followed by a limited scale trial involving 10 seventh-grade students at SMPN 8 Banjar. The data from the limited scale trial based on the student response questionnaire is as follows.

**Table 3.** Limited Scale Trial Data

| **Limited Scale** | **Questionnaire Score** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Score Total | 142 | 139 | 136 | 132 | 139 | 142 | 142 | 142 | 138 | 143 |
| Percentage | 94.7 % | 92.7 % | 90.7% | 88% | 92.7% | 94.7% | 94.7% | 94.7% | 92% | 95.3% |
| Score Total | 1386 | | | | | | | | | |
| Percentage | 93.02 % | | | | | | | | | |
| Criteria | Very Positive | | | | | | | | | |

A limited-scale trial was conducted on ten seventh-grade students at SMPN 8 Banjar to determine the readability, practicality, and initial response to the Culturally Responsive Teaching-based teaching module. Based on the results of the student response questionnaire, the scores varied but generally showed a very positive trend. Almost all respondents gave high ratings to the clarity of content, material integration, readability, and relevance of the module to their learning experiences. The highest student response came from students who considered the module very helpful in understanding the material on quadrilateral shapes through the context of local culture. Although there were differences in scores between respondents, the overall percentage showed a very good trend. This indicates that the teaching module is not only easy to understand but also interesting and suitable for the needs of students in the field.

Overall, the results of the small-scale trial showed an average percentage of student responses in the very positive category. Thus, the teaching module developed can be declared practical for use in mathematics learning. This positive response also shows that the integration of Banjar City's cultural sites into mathematics material has succeeded in creating a more contextual and meaningful learning experience. The results of this trial also serve as the basis for continuing to the large-scale implementation stage in several other schools in Banjar City. With these findings, it can be confirmed that CRT-based teaching modules have strong potential to increase student engagement in learning

and support the achievement of learning objectives that are more inclusive and responsive to cultural diversity. The following is documentation of the limited-scale trial in this study.

**Figure 3.** Limited Scale Trial

### *3.4 Implementation Stage*

#### 3.4.1 SMPN 1 Banjar

The implementation stage is an important stage in the development of Culturally Responsive Teaching (CRT)-based teaching modules, because at this stage, products that have undergone expert validation and limited trials are actually applied in a broader learning context. After the teaching module was declared feasible and received very positive responses from students in limited trials, the product was then tested on a larger scale involving five schools in Banjar City, namely SMPN 1, SMPN 2, SMPN 6, SMPN 8, and SMPN 9. The schools were selected to represent the diversity of students in Banjar City, which consists of different ethnic, linguistic, and cultural backgrounds.

The implementation was carried out in seventh grade classes, with experimental and control classes in each school. The experimental classes used CRT-based teaching modules, while the control classes continued to use conventional learning methods in accordance with the textbooks normally used by teachers. This strategy was designed to objectively determine the difference in learning outcomes between students who learned using innovative modules and students who learned using traditional learning approaches.

During the implementation phase, teachers acted as facilitators who guided the learning process in accordance with the module design. The teaching module, which integrated cultural sites in the city of Banjar, was applied to the subject of quadrilateral shapes so that students could understand mathematical concepts through real-life contexts that were familiar to them (Puspita et al., 2025). For example, students are invited to associate the shapes of certain buildings or cultural sites with the properties of flat shapes, so that learning becomes more contextual, meaningful, and in line with CRT principles. In addition to focusing on learning outcomes, the implementation stage also pays attention to the affective and psychomotor aspects of students (Rahmah & Fitria, 2022). Teachers observe the extent to which this module can increase students' motivation, confidence, and involvement in group discussions and collaborative activities. This is important considering that CRT not only aims at cognitive achievement but also builds cultural awareness, cooperation, and appreciation for diversity.

Before conducting the ANCOVA, assumptions were tested to ensure the analysis was appropriate. The results showed that all ANCOVA assumptions were met: the homogeneity of variances was satisfied as indicated by a non-significant Levene's test, the homogeneity of regression slopes was confirmed through the interaction test, and residual diagnostics demonstrated that the residuals were normally distributed and showed no signs of heteroscedasticity. These findings indicate that the dataset met the necessary statistical assumptions, allowing the ANCOVA results to be interpreted reliably. To test the effectiveness of the module quantitatively, an experimental design was used with pre-test and post-test measurements on both groups. Data analysis was performed using Analysis of Covariance (ANCOVA), which allows for comparisons of student learning outcomes while accounting for initial scores. With this approach, a more accurate picture of the effect of using CRT-based teaching modules on improving student mathematics learning outcomes in each school was obtained.

After the Culturally Responsive Teaching (CRT)-based teaching module was declared feasible through expert validation and limited-scale trials, the next stage was large-scale implementation. One of the schools where it was implemented was SMPN 1 Banjar. At this stage, student learning outcomes were measured using an experimental design that compared the experimental class using the CRT teaching module and the control class using conventional learning. Measurements were taken through pre-tests and post-tests to determine the effectiveness of the modules in improving mathematical concept understanding, particularly in the subject of quadrilateral shapes. Data analysis used Analysis of Covariance (ANCOVA), which was chosen to control for the influence of differences in initial scores between groups, so that the results obtained were more accurate in showing the effect of the treatment.

**Table 4.** Results of the Ancova Pre-Test and Post-Test at SMPN 1 Banjar

| Univariate Tests | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: PosTes | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Contrast | 595.929 | 1 | 595.929 | 15.030 | .000 |
| Error | 2418.563 | 61 | 39.649 | | |

The results of the ANCOVA analysis at SMPN 1 Banjar show that there is a significant difference between the experimental class and the control class after the treatment was given. The significance value of the test is below the limit of 0.05, which means that the CRT-based teaching module has a significant effect on improving students' mathematics learning outcomes. This can be seen from the comparison of post-test scores, which were higher in the experimental class than in the control class, even though both classes had relatively comparable initial conditions based on their pre-test scores.

These findings show that the integration of Banjar City's cultural sites into mathematics learning made the concept of quadrilateral shapes more contextual and easier for students to understand. Learning that was previously abstract becomes more meaningful because it is linked to real objects that are close to students' lives. Thus, the application of the CRT teaching module at SMPN 1 Banjar has proven to be effective in improving mathematical concept understanding while encouraging students to be more active and involved in the learning process. The following is documentation of the research activities at SMPN 1 Banjar:

**Figure 4.** Large-scale trial at SMPN 1 Banjar

### 3.4.2 SMPN 2 Banjar

The implementation of Culturally Responsive Teaching (CRT)-based teaching modules at SMPN 2 Banjar was carried out by comparing the experimental class that used the modules with the control class that continued to use conventional learning methods. The effectiveness of the modules was analyzed by measuring student learning outcomes through pre-tests and post-tests. Furthermore, the data were analyzed using Analysis of Covariance (ANCOVA) to see the difference in learning outcomes

after treatment, while controlling for the influence of initial scores. The use of ANCOVA allowed researchers to ensure that the improvement was due to CRT-based learning rather than other factors.

**Table 5.** Results of Ancova Pre-Test and Post-Test Tests at SMPN 2 Banjar

| Univariate Tests | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: POSTEST | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Contrast | 160.454 | 1 | 160.454 | 7.181 | .009 |
| Error | 1362.992 | 61 | 22.344 | | |

The results of the ANCOVA analysis at SMPN 2 Banjar showed that there was a significant difference between the experimental class and the control class. The significance value obtained was below 0.05, which means that the use of CRT-based teaching modules had a significant effect on improving student learning outcomes. The experimental class that used modules with local cultural integration showed a higher increase in mathematical concept understanding compared to the control class.

These results show that mathematics learning linked to the cultural context of students makes it easier for students to understand the material and increases their motivation to learn. The teaching module not only serves as an additional learning resource, but also as a medium that provides a more contextual learning experience. Thus, the application of CRT at SMPN 2 Banjar can be said to be successful in helping students master the material on quadrilateral shapes more effectively than the conventional approach. The following is documentation of the research implementation at SMPN 2 Banjar:

**Figure 5.** Large-scale trial at SMPN 2 Banjar

### 3.4.3 SMPN 6 Banjar

The implementation of Culturally Responsive Teaching (CRT) based teaching modules at SMPN 6 Banjar aims to test the effectiveness of the product in improving students' mathematics learning outcomes. As in other schools, testing was conducted by comparing the experimental class that used CRT teaching modules and the control class that followed conventional learning. Learning outcomes were evaluated through pre-tests and post-tests, which were then analyzed using Analysis of Covariance (ANCOVA). This analysis method was chosen because it is able to take into account differences in initial scores so that the results obtained are more accurate in assessing the effect of the treatment.

**Table 6.** Results of the Ancova Pre-Test and Post-Test at SMPN 6 Banjar

| Univariate Tests | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: POS_TEST | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Contrast | 512.547 | 1 | 512.547 | 15.762 | .000 |
| Error | 1853.555 | 57 | 32.519 | | |

The results of the ANCOVA analysis at SMPN 6 Banjar showed that there was a significant difference between the experimental class and the control class after the treatment was given. The significance value obtained was below 0.05, indicating that the use of CRT-based teaching modules had a significant effect on improving students' mathematics learning outcomes. In other words, students who learned using this teaching module were able to gain a better understanding of the concept of quadrilateral shapes compared to students who learned using conventional methods.

This finding reinforces the evidence that integrating the local cultural context into mathematics learning has a positive impact, both in increasing learning motivation and in deepening conceptual understanding. The CRT-based teaching module at SMPN 6 Banjar not only functions as a medium for delivering material but also as a bridge connecting abstract mathematical knowledge with the socio-cultural reality of students. This is in line with the objectives of Culturally Responsive Teaching, which places cultural diversity as a source of learning that enriches students' academic experiences. The following is the implementation of research activities at SMPN 6 Banjar:

**Figure 6.** Large-scale trial at SMPN 6 Banjar

### 3.4.4 SMPN 8 Banjar

The implementation phase of the Culturally Responsive Teaching (CRT)-based teaching module at SMPN 8 Banjar was carried out with the aim of assessing the effectiveness of the product in improving students' understanding of mathematics material. As with other schools, learning was conducted by comparing the experimental class, which used the CRT-based teaching module, and the control class, which continued to learn using the conventional approach. The success of the learning process was evaluated through pre-tests and post-tests, and the results were analyzed using Analysis of Covariance (ANCOVA). This technique was used to control for differences in students' initial abilities so that the results obtained were more objective in showing the effect of the treatment.

**Table 7.** Results of the Ancova Pre-Test and Post-Test at SMPN 8 Banjar

| Univariate Tests | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: POS_TEST | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Contrast | 247.234 | 1 | 247.234 | 7.383 | .009 |
| Error | 2042.761 | 61 | 33.488 | | |

The results of the ANCOVA analysis show that there is a significant difference between the experimental class and the control class at SMPN 8 Banjar. The significance value obtained is less than 0.05, which indicates that the use of CRT-based teaching modules has a significant effect on improving student learning outcomes. Students who learn with these teaching modules achieve better results on the final test than those who learn with conventional methods.

This indicates that mathematics learning linked to the local cultural context can increase student engagement and help them understand the concepts being studied more concretely. The teaching module not only provides an interesting learning experience, but also fosters a sense of connection between students and their cultural environment. Thus, the implementation of the CRT-based teaching module at SMPN 8 Banjar has proven to be effective in supporting more inclusive, contextual, and meaningful mathematics learning. The following is the implementation at SMPN 8 Banjar:


**Figure 7.** Large-scale trial at SMPN 8 Banjar

### 3.4.5 SMPN 9 Banjar

The implementation of Culturally Responsive Teaching (CRT)-based teaching modules at SMPN 9 Banjar was carried out as part of a large-scale trial to test the effectiveness of the product in improving mathematics learning outcomes. As in other schools, a comparison was made between the experimental class that used CRT teaching modules and the control class that continued to use conventional methods. Learning outcomes were evaluated using pre-tests and post-tests, which were then analyzed using Analysis of Covariance (ANCOVA). This analysis allowed researchers to objectively assess differences in learning outcomes after treatment by controlling for variations in students' initial abilities.

**Table 8.** Results of Ancova Pre-Test and Post-Test at SMPN 9 Banjar

| Univariate Tests | | | | | |
|---|---|---|---|---|---|
| Dependent Variable: POS_TES | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Contrast | 363.729 | 1 | 363.729 | 11.236 | .001 |
| Error | 1942.222 | 60 | 32.370 | | |

The ANCOVA test results show that there is a significant difference between the experimental class and the control class at SMPN 9 Banjar. The significance value obtained is less than 0.05, so it can be concluded that the use of CRT-based teaching modules has a real effect on improving students' mathematics learning outcomes. Students in the experimental class who learned with the CRT teaching module showed better conceptual understanding and higher final test scores compared to students in the control class.

These findings prove that mathematics learning that integrates local cultural contexts through the CRT model not only makes it easier for students to understand abstract concepts, but also encourages their active involvement in the learning process. The teaching modules developed are able to bridge mathematical understanding with cultural experiences that are close to students' daily lives. Thus, the implementation at SMPN 9 Banjar further strengthens the evidence that the CRT approach is effective

in creating contextual, inclusive, and meaningful mathematics learning. The following are the implementation activities at SMPN 9 Banjar:


**Figure 8.** Large-scale trial at at SMPN 9 Banjar

### *3.5 Evaluation Stage*

The final stage, evaluation, is carried out by assessing activities and evaluating each step taken at each stage, from the analysis stage to the implementation stage. In the analysis stage, evaluation is carried out based on the next stage, which is design. Evaluation in the design stage is based on the next stage, which is development, and evaluation in the development stage is based on the final stage, which is implementation. Each stage is carried out to obtain feedback from students through implementation activities with the aim of obtaining information about the feasibility of the teaching modules that have been developed. The responses given by students to the teaching modules developed were very positive. Culturally Responsive Teaching Efficacy CRTSE collects in-depth data, obtains information about the experiences, perceptions, and opinions of respondents, and identifies patterns or themes. In this case, the questionnaire observation was conducted on Culture-Based Learning in Schools, particularly in mathematics learning.

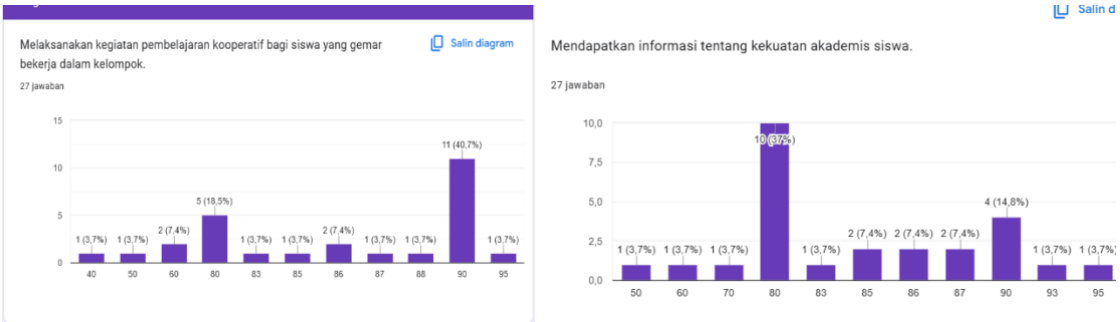


**Figure 9.** Culturally Responsive Teaching Questionnaire

The results of the Culturally Responsive Teaching Self Efficacy questionnaire show aspects of implementing cooperative learning activities for students who enjoy working in groups. This ranked highest with a score of 40.7%. Obtaining information about students' academic strengths and helping students develop positive relationships with their peers in the classroom ranked second with a score of 37%. Identifying ways in which students communicate at home that may differ from school norms, obtaining information about students' cultural backgrounds, designing instructions that are appropriate for students' developmental needs, and organizing parent-teacher conferences so that the meetings are not intimidating for parents ranked third with a score of 33.3%, while other aspects received lower percentages.

This study produced several key findings related to the development of the culturally responsive mathematics module and the CRTSE instrument. First, the module demonstrated strong validity, with expert evaluations yielding an average score of 3.875 in the "very good" category, and high practicality as shown by the 93.02% positive response rate during the limited trial. Second, in relation to the effectiveness of the module, ANCOVA results across five schools consistently showed significant differences between the experimental and control classes, indicating that the CRT-based module

contributed to improved student mathematics achievement after controlling for pre-test differences. Third, regarding teacher self-efficacy, the CRTSE results revealed that teachers reported the highest confidence in facilitating cooperative learning (40.7%), followed by identifying students' academic strengths and promoting positive peer interactions (37%), while aspects related to understanding students' cultural backgrounds and communication patterns showed moderate levels (33.3%). Taken together, these findings address all research questions by demonstrating that the developed module is valid, practical, and effective, and that the CRTSE Scale provides meaningful evidence of teachers' self-efficacy in implementing culturally responsive mathematics instruction.

***Discussion***

The results of this study indicate that the Culturally Responsive Teaching (CRT)-based mathematics teaching module, which integrates the cultural sites of Banjar City, is considered highly feasible by experts. The module is considered appropriate in terms of content, language, and appearance, making it a suitable innovative learning medium. The integration of culture into the subject matter of quadrilateral shapes not only makes learning more contextual, but also provides a learning experience that is closer to the daily lives of students (Mailani et al., 2024). Student responses during the limited-scale trial phase were also very positive. They found the teaching module easy to understand, interesting, and relevant to their lives (Micallef, 2025). This proves that the CRT approach can help students connect mathematical concepts, which are usually abstract, with the reality of local culture. Thus, learning becomes more meaningful and encourages active student involvement during the learning process.

The implementation of a large-scale trial in five junior high schools in the city of Banjar further strengthened these findings. The results show that learning using CRT-based modules is more effective than conventional learning. Students who used these modules demonstrated better conceptual understanding and increased motivation to learn. This success confirms that culture-based learning strategies not only enrich the learning experience but also contribute significantly to improving mathematics learning outcomes (Thoman et al., 2025). In addition, this study also measured teachers' self-efficacy in implementing culturally responsive learning through the Culturally Responsive Teaching Self-Efficacy (CRTSE) instrument. The questionnaire results showed that teachers felt most confident in creating a cooperative and collaborative learning atmosphere. They also had sufficient confidence in understanding students' academic strengths and building positive relationships in the classroom (Arum & Hanif, 2025). However, there are still other aspects that need to be improved, such as a deeper understanding of students' cultural backgrounds and parental involvement in the learning process.

When compared with international and national studies, the present findings show considerable alignment with prior research on culturally responsive pedagogy and teacher efficacy. Consistent with Cruz et al. (2019) and Zakariya & Adegoke (2024), higher teacher confidence in specific CRT practices (e.g., facilitating cooperative learning and recognizing students' academic strengths) corresponded with observable improvements in classroom processes and student engagement. Likewise, the effectiveness of culture-integrated instruction in improving mathematical understanding parallels results from studies on culturally responsive mathematics (Laksana et al., 2021; Hendricks et al., 2024), which report that contextualizing geometry and measurement in local artefacts enhances conceptual grasp and motivation. The strong expert validation and high student practicality ratings in our study echo reports from similar R&D efforts that combine material design with classroom trials, reinforcing the claim that well-designed, contextually anchored modules are both feasible and impactful in diverse classrooms.

There are also meaningful divergences that merit attention. While many international studies emphasise CRT primarily in language and social studies, our results show robust effects in mathematics, possibly because the module explicitly linked quadrilateral concepts to salient local cultural sites, thereby reducing the abstraction that typically hampers mathematics learning. Another

divergence is the moderate scores on items related to deep cultural knowledge and parental engagement; whereas some studies in other contexts report stronger teacher capacity in these areas, the lower levels found here may reflect limited prior professional development on ethnomathematics in the region, differing expectations about teacher–parent roles, or practical constraints (time, curriculum pressure) that limit culturally rich home–school connections. These contextual differences suggest that while the broad benefits of CRT are transferable, the specific design and support structures (training, community involvement, curricular flexibility) must be adapted to local educational ecologies to realize the full potential of CRT in mathematics.

Overall, this study confirms two important things. First, CRT-based teaching modules have been proven to be valid, practical, and effective for use in mathematics learning in schools with cultural diversity. Second, the CRTSE instrument can be a useful tool for evaluating teachers' confidence in implementing culturally responsive learning. With these two findings, it is hoped that teacher professional development can be more focused, while also supporting the implementation of the Merdeka Curriculum in the context of multicultural education in the city of Banjar.

## 4. CONCLUSION

This study developed a Culturally Responsive Teaching Self-Efficacy (CRTSE) Scale and a culturally integrated mathematics module for junior high schools in Banjar City using the ADDIE model. The development process produced two key contributions. First, the culturally responsive mathematics module, validated by experts and positively received by students, indicates strong potential to support more contextual and engaging mathematics learning. The classroom implementation further suggests that integrating local cultural contexts can meaningfully enhance students' conceptual understanding. Second, the CRTSE scale offers an initial but valuable tool for assessing mathematics teachers' confidence in implementing culturally responsive practices. The findings indicate that teachers feel most confident in facilitating collaborative learning and recognizing students' academic strengths, while also highlighting areas where further professional development may be beneficial. Overall, this study supports the view that culturally grounded instructional tools and teacher self-efficacy assessment instruments can contribute to strengthening inclusive, meaningful, and context-sensitive mathematics education. These contributions align with Indonesia's multicultural educational goals and the aspirations of the Merdeka Curriculum, which emphasize localized, student-centered, and culturally responsive learning.

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