



# Enhancing Teacher Competence in Designing Culturally Contextualized Differentiated Mathematics Assessment

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**Abstract.** Differentiated mathematics learning assessment is an essential element that can optimize learning by the principles of the Merdeka Curriculum. This study aims to improve teachers' ability to develop differentiated mathematics learning assessments, especially those by the Merdeka Curriculum and the socio-cultural context. This descriptive qualitative study uses the explanatory type of Participatory Action Research (PAR) method. The subjects in this study were 24 primary school teachers. The activity was carried out in 3 stages: problem identification, implementation, and evaluation. The instruments used in this study were written tests, questionnaires, and documentation. The data analysis technique used was descriptive statistics for quantitative data, focusing on summarizing and presenting data. This study's results show increased teachers' ability to design differentiated assessments based on the socio-cultural context through pretest and posttest results. The average score for the pretest was 51.25, while the average score for the posttest was 79.3, increasing to 28.05. In addition, the achievement of teacher indicators in designing assessments is 93.3%, meaning that most teachers can design differentiated assessments according to the socio-cultural context. Meanwhile, the questionnaire results showed that the participants (teachers) responded positively to implementing the assessment preparation workshop. The overall average score of the questionnaire was 4.08, with the criteria of good. The results of this activity are expected to strengthen the capacity of elementary school teachers to implement differentiated mathematics learning assessments in the Merdeka Curriculum by considering socio-cultural diversity.

**Keywords:** Mathematics Learning Assessment, Differentiated Learning, Socio-cultural Contexts.

## 1 Introduction

Merdeka Curriculum, as the foundation of the educational revolution in Indonesia, emphasizes a responsive and effective learning approach, primarily focusing on understanding the needs and interests of students [1]-[3]. In this context, differentiated assessment in mathematics learning becomes a crucial element that can optimize learning according to the principles of the Merdeka Curriculum [3], [4]. Differentiated

according to the principles of the Merdeka Curriculum [3], [4]. Differentiated mathematics assessment allows teachers to provide variations in material choices, methods, and learning products tailored to the learning needs of students [5].

However, teachers still use assessments based on a 'one size fits all' criterion or the same standardized assessment for all students, even though the learning is differentiated [6]. This can result in assessments that do not consider the learning needs of students. Teachers' assessments of student performance play a significant role in several important decisions, such as teaching planning and student placement [7], [8]. In the learning context of the Merdeka Curriculum era, socio-cultural context is also emphasized. Materials relevant to students' daily lives and socio-cultural context are more likely to engage their interest and involvement [9]. This can enhance motivation and learning outcomes. Furthermore, assessments based on sociocultural contexts prepare students to interact in a diverse society. Students learn to appreciate differences and collaborate with people from various backgrounds. Socio-culturally based differentiated assessments are important for improving learning outcomes and creating a fair, inclusive, and relevant learning environment for all students [10], [7].

Based on a survey conducted by researchers among elementary school teachers in Pasuruan Regency, it was found that the implementation of differentiated mathematics assessments emphasizing socio-cultural context is still minimal among teachers. The limited knowledge of teachers regarding differentiated mathematics assessments is a major barrier. Teachers have limitations in understanding and applying assessment principles that can accommodate student diversity. This can lead to difficulties in designing assessments that align with the unique characteristics of each student, posing a serious challenge in achieving the goals of the Merdeka Curriculum, which emphasizes responsiveness to individual student needs [5], [11]. Furthermore, the lack of teacher knowledge in linking socio-cultural aspects to assessments is a significant second issue [12]. In the context of the Merdeka Curriculum, integrating local values and the socio-cultural diversity of students is essential. Teachers who do not understand how to connect these aspects in assessments may produce less contextual and culturally relevant learning experiences for students. Therefore, teachers must adapt mathematics learning strategies relevant to the culture in the students' surroundings and adjust teaching methods to suit students' learning styles [13]. This supports the principle of inclusivity and strengthens diversity in the learning process [14].

Various activities can be organized to enhance understanding and implementation of differentiated learning, such as training, mentoring, or workshops on designing mathematics assessments linked to socio-cultural contexts [15], [16]. Research related to differentiated learning has also been conducted, such as the study by [17] titled "Analysis of the Implementation of Differentiated Learning in the Implementation of the Merdeka Curriculum in Elementary School Mathematics," which shows that differentiated learning is one of the efforts in a series of lessons that consider students' needs in terms of learning readiness, student learning profiles, interests, and talents. Research conducted by [18] titled "Continuous Professional Development Based on Literacy, Numeracy, and Differentiated Learning for Elementary School Teachers in the Pangeran Tamjidillah Cluster" indicates that teachers have not yet mastered competencies related to differentiated learning and its assessments. Therefore, teachers are expected to integrate

differentiated learning more effectively into their teaching activities [19]. This increased understanding benefits teachers and positively impacts students' learning experiences. Through the application of differentiated mathematics assessments, it is hoped that the teaching conducted by teachers can become more effective [20], [12]. By meeting the needs and interests of students more personally, the Merdeka Curriculum can better support the development of each student's unique potential in the region.

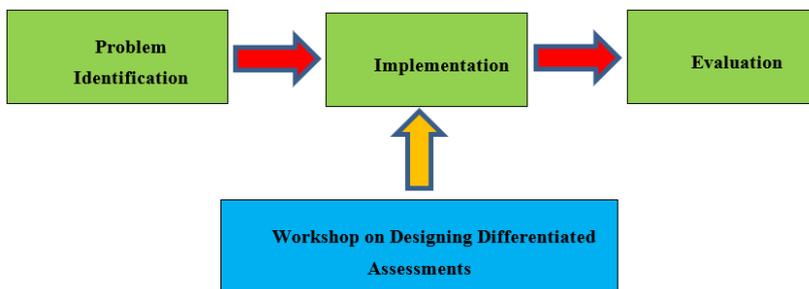
Based on the background above, improving teachers' knowledge and skills in differentiated mathematics assessments and applying sociocultural aspects in assessments becomes a critical step to enhance teacher competencies and support the successful implementation of the Merdeka Curriculum. It is believed that differentiation in teaching is the right approach to reach diverse learners, and differentiation in assessment is equally important to ensure accurate progress reports are generated to inform learning.

## **2 Method**

### **2.1 Research Design**

This research is a qualitative descriptive study employing an explanatory type of Participatory Action Research (PAR). Explanatory PAR facilitates communities participating in analyzing needs, problems, and solutions, and subsequently planning actions [21]. This research method is chosen for its complexity in identifying and achieving the objectives outlined in the field, and it involves researchers collectively and collaboratively engaging with the subjects of study to generate knowledge, reflective follow-up, and ultimately produce current changes and benefits that can be experienced collectively.

The activities are carried out through three stages: problem identification, implementation, and evaluation. During the implementation stage, three technical activities are conducted: brainstorming, discussion, and workshops (Fig. 1). Brainstorming is used to assess teachers' readiness regarding the assessments applied in the Merdeka Curriculum. Discussions are held to allow participants to share their experiences and understanding of the issues faced in implementing the Merdeka Curriculum, particularly concerning assessment. These discussions create space for the exchange of ideas, solutions, and innovative thoughts. The facilitator provided focused guidance to ensure a deeper discussion on differentiated mathematics learning assessments and the integration of socio-cultural aspects in evaluation [14], [16].



**Fig. 1.** Participatory Action Research (PAR) stages.

**2.2 Population and Data Collection Method**

The implementation was conducted directly at SMPN 1 Bangil, Pasuruan Regency, with 24 participants from the teacher working group (KKG) of elementary schools in Pasuruan Regency. The data collection techniques used were observation, written tests, response questionnaires, and documentation. The observation aimed to monitor the participants' behavior during the discussions. Written tests were used to measure participants' understanding of assessments in the Merdeka Curriculum. These tests were administered before the activities began (pretest) and after the activities concluded (posttest). The response questionnaires were given to obtain feedback from the participants after carrying out this activity, so that the feedback results could be used for further improvement and development.

**2.3 Data Analysis**

The analysis technique used was descriptive for quantitative data, summarizing and presenting the data in an easily understandable format. This approach involved calculating the percentage increase in teachers' ability to design learning assessments, which can be seen through the results of the pretest and posttest. This approach was chosen because it can measure the initial ability before the research was conducted and after the research was completed. The success of this research can be seen based on several categories, namely: 1) there is an increase in the overall average score of participants from pretest to posttest; 2) achievement of indicators in designing socio-culturally based differentiated assessments; and 3) participants' response questionnaires falling into the "Good" category at a minimum. The criteria for determining the results of the questionnaire are listed in Table 1.

**Table 1.** The Aspect of the Questionnaire Result (AR).

| Score                 | Criteria    |
|-----------------------|-------------|
| $4,20 < AR \leq 5$    | Very Good   |
| $3,40 < AR \leq 4,20$ | Good        |
| $2,60 < AR \leq 3,40$ | Fairly Good |
| $1,80 < AR \leq 2,60$ | Poor        |

### 3 Result and Discussion

This research began with the implementation stage, where participants filled out a pretest by accessing a link and completing the pretest questions through a Google Form that had been shared. The pretest was conducted to identify participants' knowledge before receiving the workshop material. The indicators used to assess participants' understanding of the Merdeka Curriculum assessments included: (1) the assessment techniques used in the Merdeka Curriculum, (2) analyzing a case related to assessment in differentiated learning, (3) diagnostic and formative assessments, and (4) socio-culturally based assessments. The results of the pretest can be seen in Fig. 2.

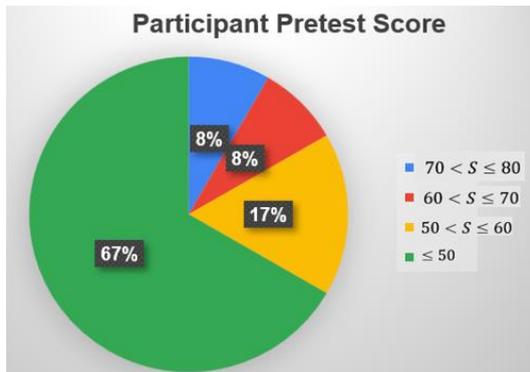


Fig. 2. Participants' pretest results.

Figure 2 shows that teachers' knowledge of mathematics assessment in the Merdeka Curriculum is still low. This can be seen from the score (S) in Fig. 2. Out of the 24 participants who completed the pretest, 67% scored below 50. In the pretest, there were 2 participants who scored 80; 2 participants who scored 70; 4 participants who scored 60; 9 participants who scored 50; 4 participants who scored 40; 2 participants who scored 30; and 1 participant who scored 20. These results indicate that the majority of teachers still lack a strong foundational understanding of assessment concepts in the Merdeka Curriculum, particularly differentiated assessment related to socio-cultural contexts. Teachers still perceive those assessments in the Merdeka Curriculum as too complicated [22]-[24].

Based on the results of the pretest, the researcher then conducted a workshop on designing socio-culturally based assessments in the Merdeka Curriculum. This workshop activity was carried out in three parts. The first activity began with a brainstorming session to assess teachers' readiness regarding the assessments applied in the Merdeka Curriculum for approximately 1 hour. Participants were encouraged to freely express

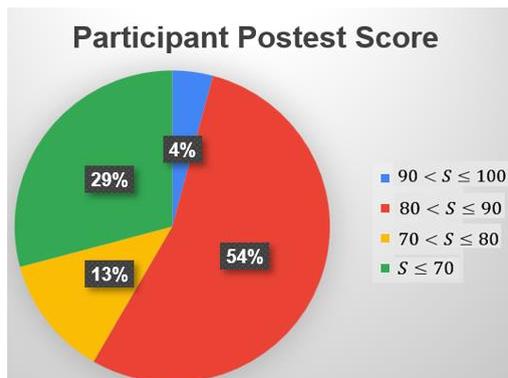
their ideas about issues related to sociocultural contexts that could be presented in mathematics learning. This activity created an environment that supports creativity and collaboration, where all participants felt comfortable contributing without fear of criticism.

The second activity involved delivering material on the concepts of assessment in the Merdeka Curriculum, which included diagnostic assessments, formative assessments, and examples of assessments with sociocultural contexts (Fig. 3). The third activity consisted of guidance in developing socio-culturally based assessments.



**Fig. 3.** Presentation of assessment concept material.

In the evaluation stage, several activities were carried out to assess the effectiveness and success of the workshop, as well as to gather feedback from the workshop participants. The first activity involves administering a posttest to the participants with the aim of evaluating the achievement of the workshop's objectives, specifically whether participants can understand the concept of socio-culturally based assessments in the Merdeka Curriculum and their ability to design assessments. The results of the posttest can be seen in Fig. 4.



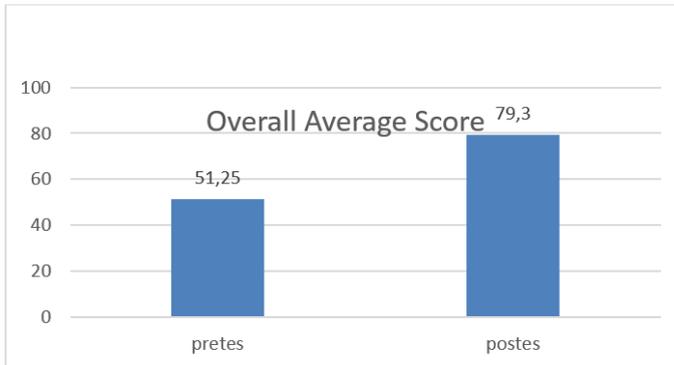
**Fig. 4.** Participants' posttest results.

Based on Fig. 4, 71% of the participants scored above 70. Out of the 24 participants who completed the pretest, there were 11 participants who scored 100, 3 participants who scored 90, 4 participants who scored 80, 4 participants who scored 70, and 2 participants who scored 60. This indicates that teachers' understanding of the assessment concepts in the Merdeka Curriculum, particularly in relation to socio-cultural contexts, has improved. Additionally, the achievement of teachers' ability to design socio-culturally based differentiated assessments is also reflected in Table 2.

**Table 2.** Achievement of indicators for teachers' ability to design differentiated assessments.

| No.                                       | Achievement indicators  | Percentage of participants meeting the indicators |
|---|---|---|
| 1   | Able to formulate assessment objectives based on Learning Outcomes                            | 100%  |
| 2   | Able to design assessments based on the socio-cultural context of the surrounding environment | 100%  |
| 3   | Able to create a differentiated assessment plan   | 80%   |
| Overall Average Achievement of Indicators |   | 93.3%   |

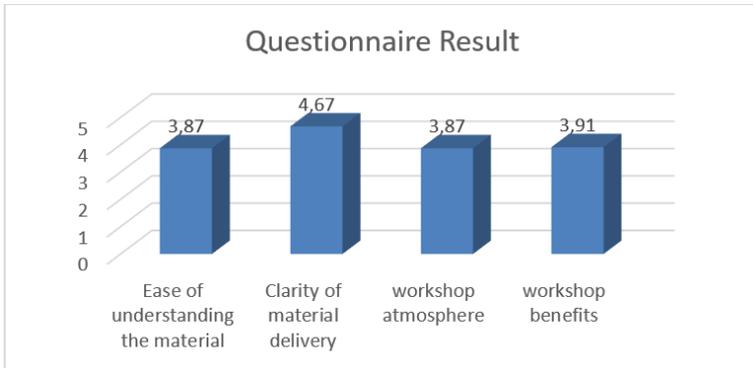
The following is Fig. 5, which illustrates the increase in the average scores of participants' abilities in designing socio-culturally based differentiated assessments, as observed from the pretest and posttest results.



**Fig. 5.** Increase in average pretest and posttest scores.

Fig. 5 above shows that there was an increase in participants' scores from the pretest and posttest results regarding socio-culturally based differentiated assessments. The average score for the pretest was 51.25, while the average score for the posttest was 79.3, resulting in an increase of 28.05. Subsequently, participants were asked to complete a questionnaire containing their impressions and feedback after attending the workshop on designing socio-culturally based differentiated assessments. The questionnaire included four main components: (1) ease of understanding the workshop material; (2) clarity of material presentation; (3) atmosphere of the workshop activities; and (4)

benefits of the workshop activities. Fig. 6 will present participants' responses after attending the Workshop on Designing Assessments.



**Fig. 6.** Questionnaire results.

Based on Fig. 6 above, it shows that participants provided positive responses to the implementation of the assessment design workshop. The average score from the questionnaire results for the aspect of ease of understanding the material was 3.87; for the clarity of material presentation, it was 4.67; for the atmosphere of the workshop, it was 3.87; and for the benefits of the workshop, it was 3.91. The overall average score of the questionnaire was 4.08, which falls into the "Good" category.

The results of the workshop had a positive impact on the knowledge and competencies of participants in designing socio-culturally based differentiated assessments. This can be seen from the assessments that some participants have designed, which align with the Merdeka Curriculum and incorporate socio-cultural contexts. Additionally, the assessments varied in ways that could facilitate students' learning needs.

These findings echo the concept of providing achievable tasks that match students' ability levels and are not constrained by rigid timelines, which can build student mastery and prepare them for higher-level tasks [25]. It also emphasizes that tasks that are too difficult for students hinder their learning progress, while giving them unchallenging tasks is considered a "missed learning opportunity."

One of the functions of differentiated assessment is to provide tasks that are appropriate for students' ability levels, thereby optimizing student mastery and preparing them to complete tasks at higher levels [25], [4]. One principle of differentiated assessment in the Merdeka Curriculum can help develop students' self-assessment and improve the quality of learning and student learning outcomes. This aligns with [26] views that assessment in the implementation of the Merdeka Curriculum emphasizes integration and focuses on something truly unique and different.

The research results indicate that training in designing differentiated assessments with socio-cultural contexts can broaden teachers' perspectives, showing that when learning is linked to the socio-cultural environment, it can enhance participation during discussions. This is consistent with research conducted by [12] which highlights several examples of culturally responsive pedagogical practices, including integrating cultural

diversity into the curriculum content, building cross-cultural communication, developing cultural competence, and creating cultural alignment in learning, which can foster interest, collaboration, and participation in problem-solving.

Empowering and mentoring teachers in designing socio-culturally based differentiated assessments through training is an effective solution, enabling teachers to skillfully develop these assessments. Furthermore, the outcomes of the training will benefit schools, making the teaching and learning process more engaging through the use of differentiated assessments [27], [28].

## 4 Conclusion

Based on the presentation of data from the research conducted through the workshop on designing socio-culturally based differentiated assessments, it can be concluded that there has been an improvement in teachers' abilities to design differentiated mathematics assessments based on socio-cultural contexts. This is evident from the average score for the pretest, which was 51.25, while the average score for the posttest was 79.3, resulting in an increase of 28.05. Additionally, the achievement of indicators for teachers in designing assessments was 93.3%, meaning that the majority of teachers were able to design differentiated assessments in accordance with socio-cultural contexts, with the average score being 80. Furthermore, the results of the questionnaire indicate that participants (teachers) provided positive responses to the implementation of the assessment design workshop. The overall average score of the questionnaire was 4.08, which falls into the "Good" category. From this research, it is hoped that teachers can design differentiated mathematics assessments that emphasize other contexts beyond socio-cultural contexts so that the assessments conducted by teachers are more varied and can better facilitate students' needs.

**Acknowledgments.** We would like to express our heartfelt gratitude to Universitas Negeri Surabaya (Unesa) for funding this research. Their support has been instrumental in facilitating the workshop on designing socio-culturally based differentiated assessments, which has significantly contributed to enhancing teachers' competencies in this area.

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