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The Effect of Differentiated and Culturally Responsive Learning on Junior High School Students' Numeracy Skills and Character in Indonesia

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Abstract

The low level of numeracy among Indonesian students, as consistently reflected in international assessments such as PISA, highlights the urgent need for innovative pedagogical approaches that address both cognitive and character development. This study aimed to examine the effect of differentiated and culturally responsive learning (DCRL) on enhancing numeracy skills and strengthening character education among junior high school students. Employing a quasi-experimental one-group pre-test–post-test design with two experimental classes**,** the research involved 72 eighth-grade students from a private junior high school in Surabaya, East Java. Data were collected through pre- and post-test numeracy assessments, classroom observations, questionnaires, and teacher interviews. The results revealed a 43.52% improvement in numeracy scores from pre-test to post-test, confirmed as statistically significant by a paired-sample t-test $p < 0.05$. Observation data showed that 87% of students actively engaged in differentiated and culturally grounded learning activities, while the development of character education was most evident in cooperation 72% and noble character 70%**,** with independence 65% and creativity 64% identified as areas for further reinforcement. Furthermore, positive responses from 90% of students and 86% of teachers confirmed the acceptability and practicality of the DCRL model. These findings demonstrate that the integration of DCRL model provides a comprehensive framework for improving numeracy achievement, fostering character formation, and supporting the holistic objectives of the *Independent Curriculum* in Indonesia.

Keywords: *Differentiated Instruction; Culturally Responsive Teaching; Numeracy Skills; Junior High School Student.*

1. INTRODUCTION

Numeracy is a fundamental competency that students must have to interpret, analyze, and apply number concepts to solve real-life problems (Anggun et al., 2025; Nuraini et al., 2025). This skill is a crucial prerequisite for active participation in modern society, from managing family finances and making critical decisions to engaging in global issues that demand data literacy and numerical-based information (Kartini et al. 2025; Mochammad Yasir & Dwiyanti 2024; Rahmania et al. 2024; Sumarno et al. 2024). In the 21st-century context, numeracy is not simply defined as mechanical calculation skills but also encompasses logical, reflective, and creative thinking skills that support evidence-based decision-making (Astuti et al. 2019; Hoffman & Barstow 2007; Susanta 2025; Varkey et al. 2023). Despite its high urgency, Indonesia still faces serious challenges in achieving numeracy skills. The Program for International Student Assessment (PISA) survey results show that Indonesia consistently ranks among the bottom ten in the world (Cabural 2024; Li, Xue, & Guo 2025; Wei et al. 2025).

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According to the PISA 2022 results, Indonesian students scored an average of 379 in mathematics, which is significantly below the OECD average of 472, placing Indonesia among the lowest ten participating countries. This fact confirms a significant gap between Indonesian students' achievements and the global average, particularly in context-oriented problem-solving skills (Hafni, Sari, & Nurlaelah 2019; Indrawatiningsih et al. 2019; Romdon, Puspowati, and Sumarmo 2018). This situation widens the disparity in learning outcomes and further emphasizes the urgency of innovation in numeracy strengthening strategies in elementary and secondary schools (Furbani 2024; Mwendwa 2018). In particular, there is a pressing need for pedagogical approaches that go beyond procedural fluency to foster higher order thinking skills such as critical reasoning, reflective analysis, and problem-solving in real life contexts (Häkkinen et al., 2017; Keleman, 2021; Nurannisa et al., 2025; Rosmiati et al., 2024, 2020). At the same time, the lack of cultural integration in mathematics instruction reduces the relevance and meaningfulness of numeracy learning, while the heterogeneity of students' readiness levels often leads to disengagement among low achievers and insufficient challenge for high achievers (Choi, Klein, & Hershberger 2015; Setambah et al. 2024, 2025). Therefore, innovative strategies must simultaneously address three dimensions: strengthening cognitive development, embedding cultural contextualization, and implementing inclusive pedagogy through differentiated instruction. Meeting these needs is crucial not only to narrow the learning gap but also to align numeracy education with the broader goals of the *curriculum*, thus preparing students to become reflective, critical, and culturally grounded citizens (Al-Kamzari & Alias 2025; Arianto &Hanif 2024; Kartini et al. 2025; Rahmania & Utama 2025).

In response to these challenges, the Ministry of Education, Culture, Research, and Technology launched the *Independent Curriculum* as an educational reform that emphasizes the restoration and strengthening of basic competencies, namely literacy, numeracy, and character education (Kartini et al. 2025; Rahmania & Utama 2025). This curriculum prioritizes the principle of differentiation as a primary strategy, enabling teachers to adapt learning content, processes, and products to suit the diverse readiness, interests, and ability profiles of students (Indrawatiningsih et al. 2019; Salido & Dasari 2019; Setyawati et al. 2023; Winch 2016). Thus, differentiation is not only a pedagogical tool but also a learning equity mechanism that enables each student to receive learning experiences relevant to their individual needs. Furthermore, the *Independent Curriculum* provides greater scope for the integration of local contexts, culture, and contemporary issues relevant to students' lives. This approach aligns with the demands of 21st-century education, which emphasizes the link between academic content and real-life skills, such as digital literacy, collaboration, and creative problem-solving. Numerous studies confirm that implementing a flexible, contextual, and culturally oriented curriculum can strengthen mathematical understanding while increasing student motivation (Adnan 2019; Fortus &Vedder-Weiss 2014; Malvigie, Novianto, & Marzuki 2023). Therefore, the *Independent Curriculum* is expected to address the issue of learning loss while facilitating the development of numeracy as a key competency that not only supports academic achievement but also prepares Indonesia's young generation to face uncertain global dynamics.

The successful implementation of the *Independent Curriculum* ultimately depends heavily on the role of teachers as adaptive and student-centered learning facilitators. Teachers are required not only to master the teaching material but also to design contextual, meaningful learning experiences tailored to students' needs (Agustan, Juniati, & Siswono 2017; Kartini et al. 2025; Noviyanti, Mariana, & Wiryanto 2025; Pramesworo et al. 2023; Rahmania and Utama 2025). In the context of numeracy strengthening, the integration of local culture and the use of digital technology are crucial strategies for making mathematics learning more engaging,

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relevant, and accessible to students from diverse backgrounds. This way, students not only learn numbers as abstract symbols but also understand the connection between numeracy and real life and the local wisdom they encounter every day (Nuraini et al., 2025; Utami et al., 2025). However, the role of teachers, as the primary agents of this learning transformation, requires ongoing support, both through continuous professional development and institutional facilitation. This support includes pedagogical training, the provision of digital learning resources, and school policies that encourage the implementation of innovative approaches. Without teacher preparedness, curriculum innovations tend to struggle to be optimally realized in the classroom. Therefore, improving teacher capacity is a prerequisite for the effective implementation of a numeracy approach based on differentiation and cultural responsiveness (Akcan 2022; Alam & Mohanty 2023; Franco, Bottiani, & Bradshaw 2024; Peterson & Jensen 2025). On the other hand, the *Independent Curriculum* emphasizes not only cognitive achievement but also character development (Andriani, Marlina & Rahayu 2023; Astuti et al. 2019)**.** This character development consists of six main dimensions, faith and noble character, global diversity, cooperation, independence, critical thinking, and creativity. These dimensions are designed to produce a cultured, resilient generation capable of making positive contributions in both national and global contexts. Therefore, strengthening numeracy in the *Independent Curriculum* is inseparable from the overarching goal of character education, which is rooted in values.

Previous studies have shown that differentiated instruction contributes significantly to improving students' problem solving skills, conceptual understanding, and learning motivation (Dinata, Suparwoto, & Sari 2020; Fajrina, Sulastri, & Gani 2020; Malvigie et al. 2023; Mariani, Mustaji, & Dewi 2025; Sahin 2010; Sari 2024; Xu et al. 2024). In addition, the Culturally Responsive Teaching approach has been proven to increase student engagement and understanding by linking mathematics content to their culture and everyday life experiences (Akcan 2022; Alam & Mohanty 2023; Franco et al. 2024; Hsu et al. 2016). Furthermore, the Culturally Responsive Teaching also plays a role in fostering attitudes of tolerance, cooperation, and creativity (Aikenhead, Calabrese, & Chinn 2006) which align with the dimensions of the students' character. Thus, the integration of differentiated and culturally responsive learning (DCRL) offers a comprehensive pedagogical framework that encompasses the cognitive, affective, and socio-cultural dimensions of learning. This framework is not only oriented towards improving numeracy but also aligns with the mission of character building. Therefore, this study aims to design and implement the differentiated and culturally responsive learning (DCRL) to enhance numeracy skills and strengthen character among Indonesian junior high school students.

2. NOVELTY

While previous research has extensively examined the effects of DCRL model in improving students' engagement and mathematical achievement, studies that explicitly integrate these two approaches within the framework of the *Independent Curriculum* remain limited in the Indonesian context. Most existing works on differentiated instruction primarily focus on its cognitive benefits, such as enhancing problem-solving skills and conceptual understanding, without explicitly addressing the socio-cultural dimensions of learning. On the other hand, studies on culturally responsive teaching have demonstrated its potential in connecting learning materials with students' cultural backgrounds, yet its application in mathematics classrooms often lacks systematic alignment with differentiated instructional strategies. This study introduces a novel contribution by designing a pedagogical model that

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synergizes differentiated instruction and to simultaneously address cognitive, affective, and socio-cultural dimensions of numeracy learning. Unlike prior research that tends to examine each approach in isolation, the present study positions their integration as a unified framework for strengthening both numeracy skills and traits mandated by the *Independent Curriculum*. Furthermore, by situating the intervention within junior high schools in Indonesia, the research offers contextual evidence on how global pedagogical concepts can be adapted to local educational reforms. This integration not only enriches the discourse on mathematics education in multicultural contexts but also provides a practical pathway for empowering teachers to design meaningful, culturally grounded, and inclusive numeracy instruction.

3. RESEARCH METHOD

3.1. Research Design

This study employed a quasi-experimental one-group pre-test–post-test design to examine the effect of DCRL model on students' numeracy skills. Three classes were used as experimental groups without a control group due to administrative and ethical considerations in the school setting (Creswell & Plano Clark 2007).

The design is illustrated as follows:

$$O_1 \quad \overset{\text{DCRL Treatment}}{\rightarrow} \quad O_2$$

where O_1 = pre-test and O_2 = post-test of numeracy skills.

3.2. *Participants and Location*

This study was conducted in Surabaya City, East Java Province, Indonesia, during the 2023/2024 Academic Year. The population of the study consisted of all Muhammadiyah 4 Junior High School students in Surabaya, East Java Province, Indonesia. The research sample included 72 second-grade students in the first semester of Muhammadiyah 4 Junior High School in Surabaya, East Java.

3.3. Data Analysing

Quantitative data were analyzed using IBM SPSS 26:

a. Normality and Homogeneity Tests were conducted to verify statistical assumptions.

b. Paired Samples *t*-test was used to compare pre-test and post-test mean differences between groups.

c. Paired Samples *t*-test was used to assess improvement within each group.

d. Qualitative responses from open-ended items were analyzed thematically to complement quantitative findings and provide contextual interpretation. (Çalik & Coll, 2012; Eliyawati et al., 2023).

4. RESULTS AND DISCUSSION

The implementation of differentiated instruction integrated with a culturally responsive teaching approach at a Junior High School in Surabaya Indonesia demonstrated a significant impact on students' numeracy development and character formation. Conducted over the course of one month with three eighth-grade classes, the intervention was designed not only to address numeracy deficiencies but also to strengthen the students' character. Data obtained

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from tests, classroom observations, and questionnaires provided a comprehensive picture of both cognitive and affective outcomes. The most striking evidence was the improvement in numeracy achievement, as reflected in the students' test results. The average pre-test score of 52.69 indicated a relatively low level of numeracy competence at the outset, highlighting the urgency of pedagogical innovations in mathematics education. Following the implementation, the post-test average increased to 75.625, representing a 43.52% gain. This improvement, as shown in Figure 1, suggests that the integration of DCRL model was effective in bridging students' conceptual gaps. The increase in performance was not merely incremental but transformative, signifying that students were able to progress from basic numerical understanding toward more advanced problem-solving abilities.

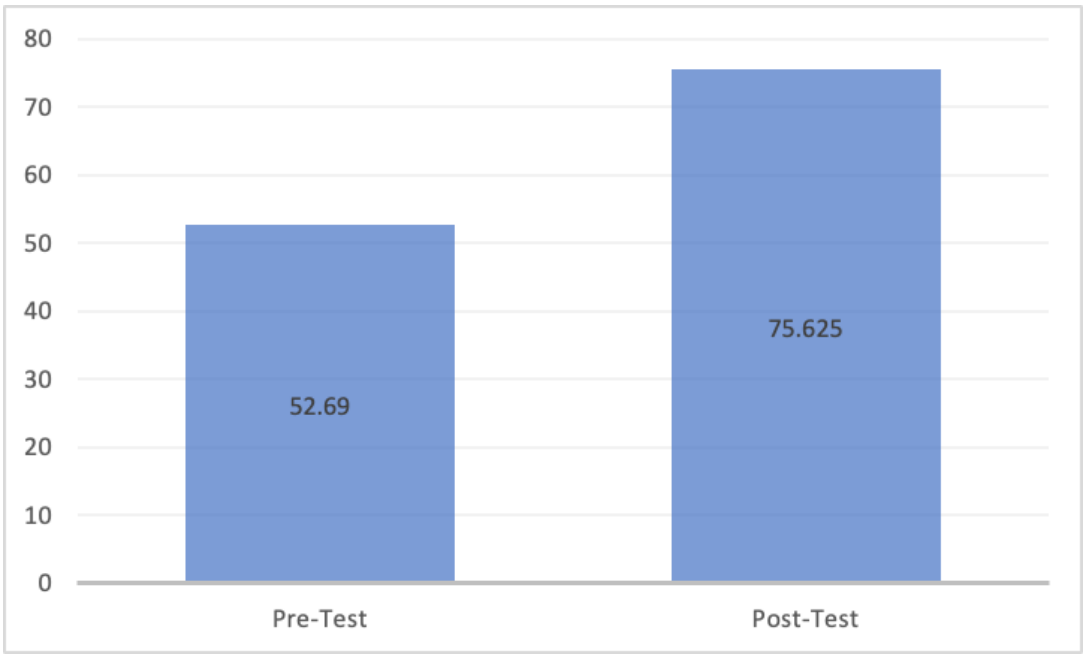

Figure 1: Students' Numeracy Scores (Pre-Test and Post-Test)

The observed improvements can be analyzed through the lens of both instructional design and cultural responsiveness. Differentiated instruction functioned as a scaffold that minimized the risk of learning gaps by providing tailored pathways for students at different levels of readiness. This approach resonates with Vygotsky's concept of the *zone of proximal development*, as learners were supported to operate slightly beyond their independent capabilities while still being challenged meaningfully (Asmi & Abdullah 2025; Noviyanti et al. 2025; Pramesworo et al. 2023). The flexibility in adjusting tasks also promoted equity by ensuring that every student regardless of prior achievement had access to cognitively engaging mathematical experiences (Indrawatiningsih et al. 2019; Kaygısız & Şenel 2023; Rosikhoh, Rofiqi, & Arjuna 2025). Meanwhile, the integration of culturally responsive teaching served as an affective bridge between abstract mathematical concepts and students' lived realities. By situating problems within culturally familiar contexts, the intervention not only enhanced comprehension but also reinforced students' sense of identity and belonging in the learning process (Anghelo Josué et al. 2023; Fajrina et al. 2020; Kuzu and Ratzke 2024; Mutlu 2020; Rui, Nasri, & Mahmud 2024). Such alignment echoes theoretical arguments that culturally relevant pedagogy can transform mathematics learning from a decontextualized activity into a meaningful practice that reflects students' socio-cultural capital (Dawson & Venville 2010; Kumar, Choudhary, & Singh 2024; Nehring et al. 2015; Robertshaw & Campbell 2013). From

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a holistic perspective, the combination of these two pedagogical strategies catalyzed both cognitive and affective growth (Budiarti & Istiyono 2023; Geng et al. 2021; Ramaila 2025; Redmond 2014). The documented rise in enthusiasm, collaboration, and confidence underscores how instructional practices that honor diversity both in learning profiles and cultural backgrounds can cultivate attributes in authentic ways. This suggests that the integration of DCRL model does not merely yield incremental improvements in numeracy outcomes, but also contributes to the broader educational mandate of the *Independent Curriculum*, nurturing learners who are critical, creative, cooperative, and grounded in cultural values (Kartini et al. 2025; Rahmania & Utama 2025). The results of the paired *t*-test confirmed that the increase in numeracy performance between pre-test and post-test was statistically significant ($p < 0.05$), as presented in Table 1.

Table 1: The Result of t-Test: Paired Two Sample for Means

	Pre-Test	***Post-Test***
Mean	52.69375	75.625
Variance	280.2862595	53.01215278
Observations	72	72
Pearson Correlation	0.335152151	
Hypothesized Mean Difference	0	
df	72	
t Stat	-12.35211921	
P(T<=t) one-tail	9.26652E-20	
t Critical one-tail	1.666293696	
P(T<=t) two-tail	1.8533E-19	
t Critical two-tail	1.993463567	

This statistical evidence underscores that the integration of DCRL model not only produced observable improvements but also generated reliable effects that cannot be attributed to random variation. The significant difference demonstrates that the combined pedagogical model was effective in fostering students' numeracy growth (Peterson & Jensen 2025).

The quantitative findings, classroom observations further corroborated the effectiveness of the DCRL model. The data revealed that 87% of students actively participated in differentiated learning activities, indicating a high level of engagement. Such engagement reflects the success of instructional practices, including grouping students according to their learning styles, adjusting the level of content difficulty, and incorporating culturally relevant materials (Akcan 2022; Alam & Mohanty 2023). These strategies ensured that learners with diverse readiness levels, preferences, and cultural backgrounds could meaningfully access and process mathematical concepts. Students' participation was characterized by active collaboration, frequent questioning, idea sharing, and visible enthusiasm throughout the lessons (Kyaw et al., 2019; Rahmat et al., 2024; Sumarno et al., 2024). These behaviors suggest that the differentiated approach created an inclusive learning environment where students were encouraged to engage cognitively and socially.

The provision of multiple entry points to the content allowed learners to interact with mathematical problems in ways that resonated with their individual strengths, thereby deepening their conceptual understanding (Mochammad Yasir & Dwiyanti 2024; Sahin 2010). The use of culturally responsive materials enhanced the contextual relevance of the learning process, making abstract numeracy concepts more accessible and relatable. By situating mathematical problems within cultural frames familiar to students, the lessons stimulated intrinsic motivation and fostered a stronger sense of belonging (Alam & Mohanty 2023;

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Argyriou 2025; Franco et al. 2024; Giglitto, Ciolfi, & Bosswick 2022; Hsu et al. 2016). Such conditions not only improved students' cognitive outcomes but also contributed to the affective domain, particularly in building confidence, collaboration, and positive attitudes toward mathematics. The differentiated approach allowed learners to access the material in ways that aligned with their individual strengths, resulting in more meaningful participation and a deeper connection to the learning process. Detailed observation data on students' participation are describe below in Table 2.

Table 2: The Observation Data on Students' Participation

Indicator	Percentage of Students	Description
Active involvement in group discussions	84%	Students actively contributed to small group or pair discussions.
Asking and answering questions during lessons	79%	Students showed curiosity and sought clarification or shared opinions.
Engagement with learning materials/tasks	90%	Students remained focused and completed assigned tasks with minimal redirection.
Willingness to express opinions or ideas	76%	Students were comfortable sharing perspectives both orally and in writing.
Demonstrating collaboration and teamwork	88%	Students cooperated effectively during peer activities and group projects.
Participation in culturally relevant activities	85%	Students responded positively to lessons incorporating their cultural context.

The observation data presented in Table 2 provide further insights into the qualitative dimensions of the learning process following the implementation of DCRL model. The results indicate consistently high levels of student participation across multiple indicators, highlighting both the cognitive and socio-emotional benefits of the integrated pedagogical model. First, active involvement in group discussions reached 84%, suggesting that the instructional strategies fostered collaborative learning environments where students felt encouraged to contribute their ideas. This finding resonates with the principle of differentiated instruction, which promotes flexible grouping to maximize interaction and peer support. Similarly, 79% of students were actively engaged in asking and answering questions, reflecting curiosity, critical inquiry, and a willingness to clarify understanding. Such behaviors demonstrate that the learning activities not only facilitated knowledge acquisition but also stimulated metacognitive engagement. The highest participation rate was observed in engagement with learning materials and tasks (90%).

Students remained focused and were able to complete assigned activities with minimal redirection, suggesting that the instructional design successfully aligned with their learning preferences and readiness levels. This finding underscores the value of differentiated tasks in sustaining attention and ensuring meaningful learning. Additionally, 76% of students showed a willingness to express opinions or ideas, both orally and in writing. Although slightly lower than other indicators, this percentage still reflects a significant shift towards building confidence and communication skills. Collaboration and teamwork also emerged as strong outcomes, with 88% of students demonstrating effective cooperation during group projects and peer activities. This level of participation is consistent with the culturally responsive dimension of the approach, which emphasizes collective problem-solving and mutual respect. Furthermore, 85% of students engaged positively in culturally relevant activities, indicating that embedding local cultural elements into mathematics lessons enhanced the relevance and authenticity of learning. By contextualizing numeracy within familiar cultural frames, students were able to connect abstract concepts with their lived experiences, thereby deepening both

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comprehension and motivation. When analyzed through the framework of students character, these findings show that the intervention not only strengthened students' cognitive skills but also supported holistic character formation. Cooperative behaviors reflect**,** active questioning and idea sharing represent critical reasoning, and sustained engagement with tasks illustrates independence**.** Participation in culturally grounded lessons corresponds to global diversity**,** while creativity emerged through students' ability to generate ideas and relate mathematical concepts with their cultural context (Akcan 2022; Franco et al. 2024). Finally, respectful and disciplined behaviors observed during activities suggest alignment with faith and noble character**.** In terms of the students' character, the implementation of DCRL model brought about significant progress in various dimensions as shown in Figure 2.

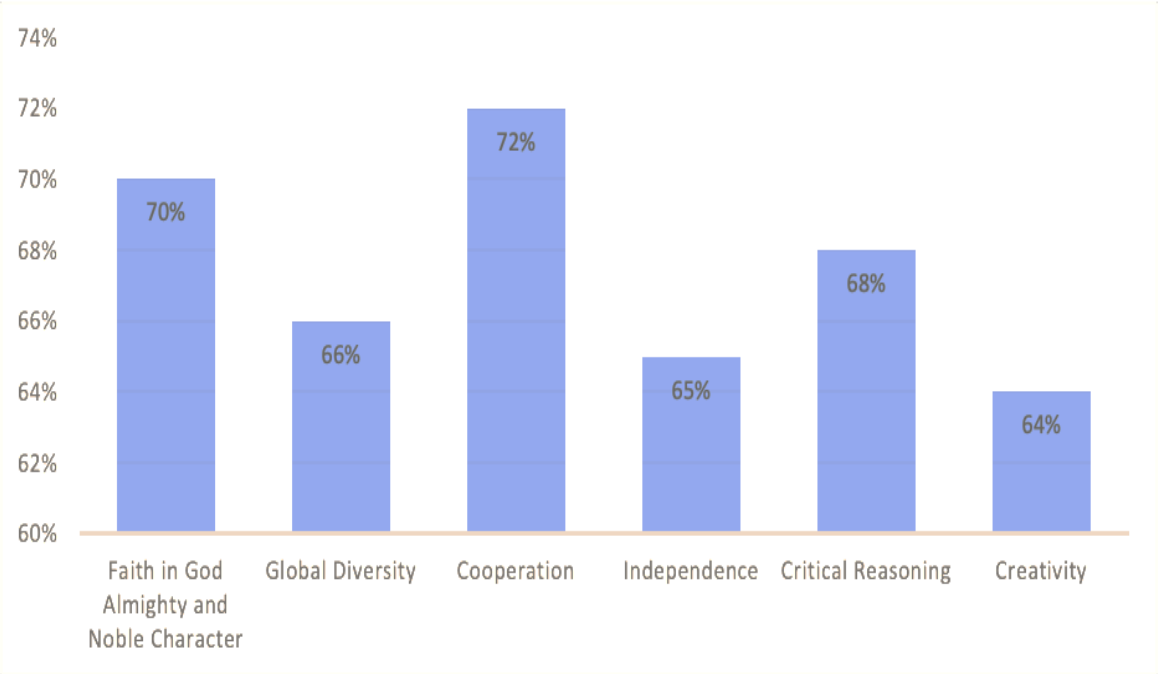

Figure 2: Students Improvement in Character Dimensions

The results displayed in Figure 2 provide empirical evidence of the extent to which the integration of DCRL model contributed to the development of students' character among junior high school students. Each dimension showed positive outcomes, although the levels of achievement varied, reflecting both the strengths and areas for further reinforcement in students' holistic character formation. The highest percentage was recorded in the dimension of cooperation (72%)**,** indicating that group-based learning strategies and culturally embedded activities effectively encouraged collaboration. Students demonstrated the ability to work together, share responsibilities, and engage constructively in discussions and projects. This aligns with the core principle of *gotong royong*, which emphasizes collective problem-solving and respect for others' contributions. Recent studies have similarly reported that collaborative learning supported by culturally responsive contexts significantly enhances teamwork and peer interaction in mathematics classrooms. The dimension of faith in God Almighty and noble character (70%) also showed strong results. This suggests that the instructional process did not merely focus on cognitive development but also integrated moral and ethical values, reinforcing respectful interaction, responsibility, and discipline during classroom activities. Such outcomes reflect the holistic intent of the *Independent Curriculum*, which places equal importance on spiritual and academic growth. Previous findings support this, showing that

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learning models integrating cultural values foster not only cognitive mastery but also moral behavior and discipline. Moderate achievements were observed in critical reasoning (68%) and global diversity (66%)**.** The relatively high score in critical reasoning indicates that students were able to analyze information, ask relevant questions, and evaluate ideas critically within numeracy tasks. This resonates with the findings of (Keleman, 2021) who highlighted that differentiated instruction improves higher order thinking by adjusting tasks to students' readiness levels. Meanwhile, the positive outcome in global diversity suggests that incorporating cultural elements into lessons helped students appreciate diversity and strengthened their awareness of intercultural perspectives. (Oladejo et al., 2025; Satianingsih et al., 2021) also emphasized that supports inclusivity and multicultural understanding, making learning more meaningful in diverse classrooms.

Lower scores were found in independence (65%) and creativity (64%). Although these dimensions still demonstrated growth, the percentages imply that students required additional support in developing self-directed learning skills and generating innovative ideas. This outcome is consistent with recent research showing that while differentiated instruction improves engagement, structured collaborative tasks may limit opportunities for autonomous and creative exploration. Future implementation should therefore incorporate more open-ended and student-driven activities to encourage greater independence and foster creativity, as suggested by (Rohaeti, Bernard, & Primandhika 2019; Setyabudhi 2023; Fitriatien & Arianto, 2025), who found that inquiry based and project based approaches provide stronger pathways for cultivating autonomy and innovation in mathematics learning. Furthermore, the findings of this study were reinforced by the positive responses provided by both students and teachers regarding the implementation of DCRL model. Students reported that the learning activities were more engaging, meaningful, and aligned with their interests and cultural backgrounds, while teachers acknowledged that the integrated approach facilitated more inclusive classroom practices and improved student participation. These perceptions strengthen the empirical results by confirming that the instructional model was not only effective in enhancing numeracy and character formation but also well-received by its primary stakeholders, ensuring its feasibility for broader application in Indonesian schools as shown in Figure 3.

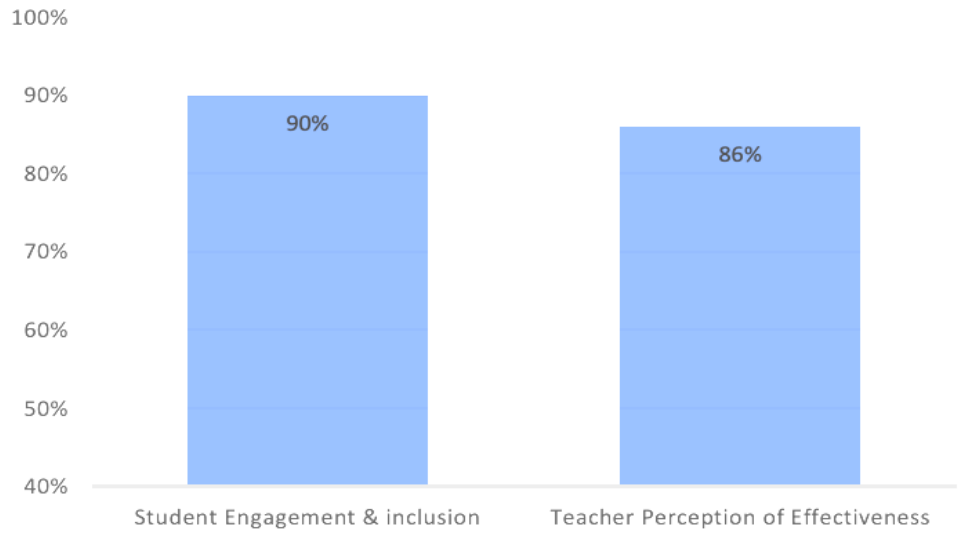

Figure 3: Student and Teacher Responses to the Implementation of Differentiated and Culturally Responsive Learning

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Figure 3 illustrates the positive responses of both students and teachers toward the implementation of DCRL model. The data show that 90% of students reported high levels of engagement and inclusion, while 86% of teachers perceived the approach as effective in supporting classroom learning. These findings highlight that the integrated pedagogical model not only improved learning outcomes but also gained strong acceptance from its primary stakeholders, which is crucial for ensuring sustainability and scalability in real classroom contexts. The high percentage of student engagement (90%) confirms that differentiated tasks and culturally relevant content made mathematics lessons more meaningful, accessible, and motivating. Students felt that their learning preferences, readiness levels, and cultural identities were respected, leading to a stronger sense of belonging in the classroom. Similar results were reported by (Akcan 2022; Day & Beard 2019; Liu, Jamaludin, & Hamzah 2025; Tanjung et al. 2025; Wojuade 2025), who found that culturally responsive mathematics instruction significantly increased student motivation and inclusivity. Likewise, (Martin-Alguacil et al., 2024; Tasniah, 2025) demonstrated that differentiated instruction promotes student centered engagement by providing multiple pathways to success, particularly in heterogeneous classrooms. On the other hand, the 86% positive perception from teachers underscores the practicality and feasibility of implementing the model. Teachers acknowledged that differentiated instruction facilitated more equitable participation, while allowed them to connect abstract mathematical concepts with students' lived experiences. These outcomes are consistent with the findings of (Ab Hajis & Othman 2024; Klepsch & Seufert 2020; Mardhatillah and Suharyadi 2023; Setambah et al. 2025) who emphasized that teachers view differentiated instruction as a viable strategy for addressing learning diversity (Tanjung et al., 2025; Wojuade, 2025) who showed that empowers teachers to create inclusive and culturally sustaining learning environments. Furthermore, (Abd-Alhamid et al. 2019; Dinham 2024; Romdon et al. 2018; Varkey et al. 2023) noted that teacher acceptance is a key factor influencing the long-term adoption of pedagogies in schools.

The integration of DCRL model in junior high school mathematics demonstrated significant impacts on students' cognitive, affective, and socio-cultural development. The average numeracy score increased by 43.52% from pre-test to post-test, with the paired *t*-test confirming a statistically significant improvement ($p < 0.05$), supporting findings by (Ab Hajis and Othman 2024; Klepsch and Seufert 2020; Mardhatillah and Suharyadi 2023; Setambah et al. 2024, 2025; Taga & Ph 2025) that differentiated instruction enhances problem-solving and conceptual mastery. Observation data further revealed that over 87% of students actively engaged in learning, with high participation in group discussions, collaboration, and culturally relevant activities, consistent with (Aikenhead et al., 2006; Franco et al., 2024; Mgboji, 2019; Wojuade, 2025) who emphasized that fosters inclusivity and differentiated instruction ensures equitable participation. The approach also strengthened dimensions of students' character, with the highest outcomes in cooperation (72%) and character (70%), while independence (65%) and creativity (64%) remained areas for growth paralleling with (Abdi, 2014; Cabural, 2024; Majidifar & Branch, 2025; Mutlu, 2020) who stressed the need to balance structured differentiation with open-ended inquiry to promote autonomy and innovation. Importantly, stakeholder responses reinforced the model's feasibility, as 90% of students reported higher engagement and inclusion, and 86% of teachers affirmed its effectiveness, aligning with who noted that teacher acceptance and student motivation are critical to sustaining pedagogical innovations. Collectively, these findings confirm that the synergy of DCRL model provides a comprehensive framework for improving numeracy, fostering students' character, and advancing the holistic goals of the *Independent Curriculum* in the 21st century.

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5. CONCLUSION

This study demonstrated that the integration of DCRL model has a significant and positive impact on students' numeracy skill and character. The findings revealed a 43.52% increase in numeracy scores from pre-test to post-test, confirmed by a paired *t*-test showing statistical significance ($p < 0.05$). In addition, observation data indicated that more than 87% of students actively engaged in learning activities, particularly in group discussions, collaboration, and culturally relevant tasks, illustrating the effectiveness of the approach in creating inclusive and motivating classrooms. The implementation also contributed to strengthening students' character, with the highest achievements observed in cooperation (72%) and noble character (70%), while independence (65%) and creativity (64%) remained areas requiring further reinforcement. Furthermore, the positive responses from 90% of students and 86% of teachers confirmed that the integrated pedagogical model was both effective and well-received, thereby ensuring its feasibility for broader application. These results collectively affirm that the synergy between DCRL model constitutes a comprehensive pedagogical framework capable of enhancing numeracy, fostering character education, and advancing the holistic objectives of the *Independent Curriculum* in preparing Indonesian students to thrive in the 21st century.

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