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Empowering students' numeracy skills: Mathematics teachers' perceptions regarding the effectiveness and challenges of Indonesian national curriculum and the programs – A mixed method study

Irma Rachmah Hidayah[1], Cholis Sa'dijah[1*], Lathiful Anwar[1], Yerizon[2], I Made Arnawa[3]
[1]Department of Mathematics, Universitas Negeri Malang, East Java, Indonesia
[2]Department of Mathematics, Universitas Negeri Padang, West Sumatra, Indonesia
[3]Department of Mathematics, Universitas Andalas, West Sumatra, Indonesia
[*]Correspondence: cholis.sadijah.fmipa@um.ac.id

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Abstract

As the Indonesian National Curriculum (INC), the Merdeka curriculum was implemented in response to students' difficulties in comprehending and utilizing basic mathematics, contributing to low numeracy skills. This study investigated mathematics teachers' perceptions in Indonesia concerning the effectiveness of INC and the supporting programs, such as the National Assessment (NA) and Pancasila Student Profile (PSP), in improving students' numeracy skills. It also aimed to identify mathematics teachers' challenges in integrating numeracy skills into the curriculum and these programs. A mixed-method study with a sequential explanatory design was used to achieve this objective. The data collection was carried out through quantitative and qualitative approaches. Closed questionnaires were explicitly used for quantitative data, while open questionnaires and interviews were used for qualitative data. Inferential statistics were used to analyze the quantitative data and a thematic analysis for qualitative data. The quantitative results showed that most teachers positively perceived the effectiveness of INC and the programs in empowering students' numeracy skills. The implementation of INC and PSP significantly influenced the empowerment of numeracy skills. The qualitative analysis provided an in-depth exploration of teachers' perceptions and the challenges faced in promoting numeracy skills in implementing INC and the programs.

Keywords:
Challenge, Effectiveness, Mixed method, Numeracy skills, Perception

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1. INTRODUCTION

The demand for mastering numeracy skills originates from diverse methods of information presented in the digital era, including images, tables, graphs, audio, and video. The ability to present and interpret information both quantitatively and qualitatively requires skills in reading, analyzing, and drawing conclusions effectively (Mason et al., 2016). The skills are foundational for solving complex problems, thinking critically, and adapting to rapid changes (Abella et al., 2024). Numeracy is crucial for academic success, lifelong learning, and empowering individuals to navigate the complexities of the modern world (Cordova Jr et al., 2024; Geiger, Goos, et al., 2015). As a primary focus of mathematics education, it is not only a tool for engaging with academic subjects but also has applications in everyday life (Dorris et al., 2021). In this case, numeracy skill is conceptualized as the foundation of mathematics, a means for active citizenship, the integration of literacy with mathematics, and a tool for decision-making and social contexts (Callingham et al., 2015).

The Indonesian government has addressed the need for an updated curriculum by implementing the Merdeka curriculum as the Indonesian National Curriculum (INC) (Yerizon et al., 2024; Yulianto, 2022; Zidan & Qamariah, 2023). The curriculum is a crucial component in achieving educational objectives (Abidin et al., 2023). According to Indonesian Government Regulation Number 4 of 2022 concerning National Education Standards, basic education in Indonesia should prioritize character development corresponding with Pancasila values and numeracy as foundational literacy (Kurniawan, 2018; Srirahmawati & Hunaifi, 2022). The focus on student character and attitudes was also present in the 2013 Curriculum (Puad & Ashton, 2023), showing the government's commitment to producing a generation that is not only intelligent and skilled but also has noble character and a national perspective (Roza et al., 2016). Pancasila, the ideology of the Indonesian nation, plays a significant role in fostering material prosperity, quality of life, national character, and noble values (Indra & Budimansyah, 2020). Education is central to instilling Pancasila values (Winarno et al., 2024). The Ministry of Education, Culture, Research, and Technology implements programs under INC, namely National Assessment (NA) (Novita et al., 2022). Furthermore, the ministry continues the essential Pancasila Student Profile (PSP) from the previous curriculum (Gayo, 2018).

INC aims to realize the objectives of PSP (Chamisijatin et al., 2023; Utami et al., 2023), which focuses on improving the quality of Indonesian education, especially in terms of character development. INC describes the core components of education (Maryani, 2023) and creates an environment that supports the development of basic literacy, including numeracy (Rahman & Dewi, 2024; Syahida & Dewi, 2023). Numeracy skill is essential in basic education, not only serving as a learning tool across subjects but also a practical skill for everyday life (Dorris et al., 2021). Moreover, the Programme for International Student Assessment (PISA) defines mathematical literacy as the ability to identify, understand, and use mathematical concepts to solve problems and make decisions in various contexts, including daily life (Genc & Erbas, 2019; Hidayah et al., 2021b; Oktiningrum et al., 2016; Smith & Morgan, 2016), work, and social interactions (Tsatsaroni & Evans, 2014).

Indonesian students' numeracy skills are relatively poor. PISA in 2022 reported an average Indonesian mathematics score of 366, a decrease from 379 in PISA 2018 (Wijaya

et al., 2024). The result of Minimum Competency Assessment (MCA), conducted by the Indonesian government, showed elementary students' scores were below average (Rohmah et al., 2022). In this case, students' inability to understand and apply basic mathematics, language, arithmetic, and information makes solving numeracy problems challenging (Hidayah et al., 2022). The Australian curriculum requires teachers at all grade levels and in all subjects to support students' numeracy skills (Geiger, Forgasz, et al., 2015; Goos et al., 2012). The curriculum includes numeracy skills as part of the educational objectives adopted by every state in Australia (Forgasz et al., 2017).

Studies have examined teachers' perceptions and readiness for curriculum reforms (Gurion, 2024; Nasution & Indrasari, 2024), as well as assessment over the last two decades (Amin et al., 2023). However, comprehensive exploration of mathematics teachers' perceptions in Indonesia regarding the effectiveness of the current curriculum and its supporting programs in empowering numeracy skills remains limited. Teachers' perceptions of educational curriculum reform were crucial because the responses, attitudes, and willingness to adopt new methods significantly impacted the success of these reforms (Prasetyono et al., 2021). In addition, the successful implementation of an effective curriculum could support educational developments, such as improving education quality, school reputation, and students' interest (Campbell-Phillips, 2020). This study filled a gap by comprehensively exploring the perceptions of mathematics teachers in Indonesia regarding the effectiveness of INC and its supporting programs on students' numeracy skills, as well as the challenges of implementation to ensure the curriculum effectively supports numeracy development across various educational contexts in Indonesia.

The current study used a mixed method with a sequential explanatory design (Cohen et al., 2000) to investigate the mathematics teachers' perceptions regarding the effectiveness of INC and its programs in supporting students' numeracy development. It also aimed to identify the challenges faced by mathematics teachers in integrating students' numeracy skills into the curriculum and programs. To achieve these aims, two main questions were addressed, namely (1) do mathematics teachers believe that INC and its programs effectively support students' numeracy development? Moreover, (2) what are the perceptions and challenges faced by mathemathics teachers in developing students' numeracy skills when implementing INC and its programs?

The study contributed significantly to the development of numeracy within INC and its programs through several main aspects. First, it provided empirical insight into the effectiveness of INC and its programs in supporting students' numeracy development from mathematics teachers' perspectives. Second, it identified perceptions and specific challenges faced by teachers in developing students' numeracy skills, facilitating the design of more effective interventions and strategies. In addition, offering recommendations with respect to the results could improve the quality of mathematics education in Indonesia, positively influencing the numeracy skills of students as well as their academic and professional success in the future.

2. METHOD

This study employed a mixed method with a sequential explanatory design (Cohen et al., 2000). The data were first collected quantitatively, followed by a qualitative phase to gather in-depth results. Furthermore, purposive sampling was used to select mathematics teachers in Indonesia who had implemented INC, NA, and PSP in schools. This study was conducted in compliance with the associated ethical and legal guidelines to protect the privacy of teachers as research subjects.

2.1. Participants

Participants for Quantitative Data

In the first phase, an online questionnaire was voluntarily completed by 192 elementary, middle, and high school mathematics teachers from various regions of Indonesia. The participating teachers came from diverse backgrounds, providing a comprehensive and in-depth understanding of the effectiveness and challenges of INC and its supporting programs to improve students' numeracy skills. The detailed characteristics of the participating teachers are presented in Table 1.

Table 1. Characteristics of teachers in this research

Category	Sub-category	Percentage (%)	Total
Educational background	Mathematics education	83.333	160
	Non-Mathematics	16.667	32
Gender	Man	28.646	55
	Woman	71.354	137
Geographical location of the school	City center	22.396	43
	Midtown	29.167	56
	Far from City Center	48.438	93
Teaching experience	More than 15 years	31.771	61
	11-15 years	29.688	57
	6-10 years	22.917	44
	Less than 5 years	15.625	30

Participants for Qualitative Data

Among the 192 initial participants, 10 were selected to represent the diverse responses and interviewed in the second phase for qualitative analysis. These 10 participants, who had completed both open and closed questionnaires, were selected to reflect various backgrounds, distinct from other interviewees, to provide a broader and more in-depth perspective.

2.2. Data Collection and Instrument

The data collection of this study was carried out using online questionnaires and interviews. The research instruments included both closed and open-ended questionnaires, as well as interview guide sheets (Cohen et al., 2000). Teachers' perceptions of the

effectiveness of INC and its supporting programs to improve students' numeracy abilities were measured quantitatively through the closed-ended questionnaire. Meanwhile, open-ended questionnaires and interview guide sheets enabled the teachers to explain their perceptions of the challenges encountered in the numeracy skills enhancement process within the implementation of INC and its programs. The questionnaire was developed using Google Forms with a structured and measurable approach, and a semi-structured interview guide was prepared for the interview process.

Quantitative Data Collection Tools

The questionnaires and interview guides were validated by two mathematics education experts from Padang universities. During the validation process, ambiguities in the instrument sentences were identified and corrected. Furthermore, new questions were added to gather more detailed teacher profile information. The revised instruments were subsequently tested on a sample of 50 teachers to assess validity and reliability.

The closed questionnaire covered two main aspects, namely background information and teachers' perceptions. The background aspect included 13 questions related to teachers and school profiles. The teachers' perceptions section consisted of 25 statements rated on a Likert scale of 1-4. Table 2 shows the statements focused on three sub-aspects, namely teachers' perspectives of the current INC, the application of NA, and the application of PSP in relation to the development of numeracy skills in mathematics learning.

Table 2. Questionnaire aspects

Aspect	Sub-aspect	Indicator of the effectivity
Teachers' perceptions	INC	1. Flexibility of practice and numeracy learning in mathematics learning with the implementation of INC 2. Support, resources, and guidance for teachers in the practice and learning of numeracy in mathematics learning with the implementation of INC 3. The usefulness of numeracy practice and learning in mathematics learning with the implementation of INC
	NA	1. Understanding the purpose and implementation mechanism of NA to measure numeracy 2. Efficiency of implementing NA to measure numeracy 3. Support, resources, and guidance for implementing NA 4. Contribution of implementing NA in developing students' numeracy and numeracy mapping
	PSP	1. Understanding the objectives and implementation mechanisms of PSP to develop the character of Pancasila and numeracy skills 2. The efficient implementation of PSP develops the character of Pancasila and numeracy skills 3. Support, resources, and guidance for PSP implementation to develop Pancasila character and numeracy skills 4. Contribution of implementing PSP in developing the character of Pancasila and numeracy skills

Qualitative Data Collection Tools

Qualitative data were collected using open-ended questionnaires and interview guide sheets. The tools helped teachers to identify critical themes reflecting their perceptions and experiences, particularly the challenges faced when developing numeracy skills in the implementation of INC and its programs. The interview guide in Table 3 was prepared to ensure a systematic approach when interviewing the ten selected subjects. In addition to these questions, follow-up questions were asked based on teachers' responses and explanations.

Table 3. Interview guidelines

Aspect	Sub-aspect	Indicator of the effectivity
Teachers' perceptions	INC	1. How effective is INC in developing students' numeracy skills? 2. What aspects of INC can support students' numeracy development? 3. What are the challenges in implementing INC in numeracy learning?
	NA	1. How effective is NA in developing students' numeracy skills? 2. What aspects can support students' numeracy development in NA? 3. What are the challenges in realizing NA's goals in numeracy learning?
	PSP	1. How effective is PSP in developing students' numeracy skills? 2. What aspects of PSP can support students' numeracy development? 3. What are the challenges in implementing PSP in numeracy learning?

2.3. Data Analysis

Quantitative Data Analysis

Questionnaire data obtained from 192 mathematics teachers were analyzed quantitatively to address the first research question. Quantitative data were analyzed using SmartPLS software to test the validity and reliability of the instruments, as well as to perform statistical analysis of the numerical data. In addition, inferential statistics such as Analysis of Variance (ANOVA) and multiple regression were used to analyze the quantitative data. These statistics help interpret the general perspectives of mathematics teachers.

Qualitative Data Analysis

Interview data from 10 teachers were processed qualitatively using a thematic analysis method with a deductive framework, facilitated by NVIVO software. Deductive themes, based on preexisting theories or frameworks, guided the coding process and theme development (Guest et al., 2012). The themes in this study included perceptions and challenges of implementing INC, NA, and PSP, all of which were developed to address the

second research question. Moreover, the themes were coded and categorized using key terms such as perception, challenge, INC NA and PSP implementation.

The combination of quantitative and qualitative analysis provided a comprehensive understanding of the perceptions and challenges of mathematics teachers regarding INC and its numeracy support programs.

3. RESULTS AND DISCUSSION

3.1. Results

Phase 1: Quantitative Study

This phase aimed to examine mathematics teachers' perceptions concerning the effectiveness of INC and the supporting programs, namely NA and PSP, in empowering students' numeracy skills. Data was collected and analyzed using SmartPLS to test the validity, reliability, and effectiveness of each variable.

A trial of the instruments was conducted to determine validity and reliability after carrying out content validity by two mathematics education experts, revising to address any ambiguities, clarifying item sentences in the instruments, as well as adding questions to explore teachers and school profile information. The instruments were tested on a sample of 50 teachers. The validity test results showed that all INC, NA, and PSP variable items had a calculated r value greater than the r table (0.2787) and a significance value of less than 0.05, confirming the validity of all items used in the research instruments. Furthermore, the reliability test results, measured by Cronbach's Alpha, showed that the instruments were highly reliable as $r_{11} \geq 0.70$ (Hidayah et al., 2021a). Table 4 presents the reliability of the instrument.

Table 4. Instrument's reliability test results

Aspect	Sub-aspect	Cronbach's Alpha	Description
Teachers' perceptions	INC	0.926	Reliable
	NA	0.949	Reliable
	PSP	0.976	Reliable

Table 4 shows that the Cronbach's Alpha value for all sub-aspects, namely INC, NA, and PSP, was >0.90. This confirmed the instruments' very high reliability. The items consistently measured teachers' perceptions of the aspects tested. Therefore, the instruments could be relied on to measure teachers' perceptions of the effectiveness of INC and its supporting programs in fostering numeracy development.

RQ 1*: Do mathematics teachers believe that INC and its programs effectively support students' numeracy development?*

Based on the results of the closed questionnaire shown in Table 5, the majority of mathematics teachers responded positively to the implementation of INC and its programs, such as NA and PSP, in supporting numeracy. Only about 10% of respondents disagreed with the effectiveness of INC and its programs in supporting numeracy.

Teachers generally responded positively to the implementation of INC and its programs, stating that INC offered support and autonomy in designing mathematics learning, facilitated students to analyze real-world problems, and improved the critical thinking processes. In addition, the projects of INC program challenged students to become effective problem solvers and productive individuals.

Some teachers expressed disagreement, citing a lack of theoretical guidance for mathematics learning under INC, potentially leading to unstructured learning. Teachers also stated that unrepresentative samples and varying students' characteristics across schools rendered the assessment process ineffective, as only students involved in NA tests were actively engaged. Some even mentioned that the project in INC left certain students struggling to grasp basic mathematics concepts, negatively influencing numeracy skills and leading to misconceptions in subsequent levels of learning.

Table 5. Results of closed questionnaires

	INC (%)	NA (%)	PSP (%)
Strongly Disagree	0.13	1.41	1.23
Disagree	4.82	9.94	9.94
Agree	70.05	65.63	65.48
Strongly agree	25.00	23.02	23.34
Total	100.00	100.00	100.00

The statistical analysis quantified INC's and its programs' influence on supporting numeracy development. The results of the multiple regression test are shown in Figure 1.

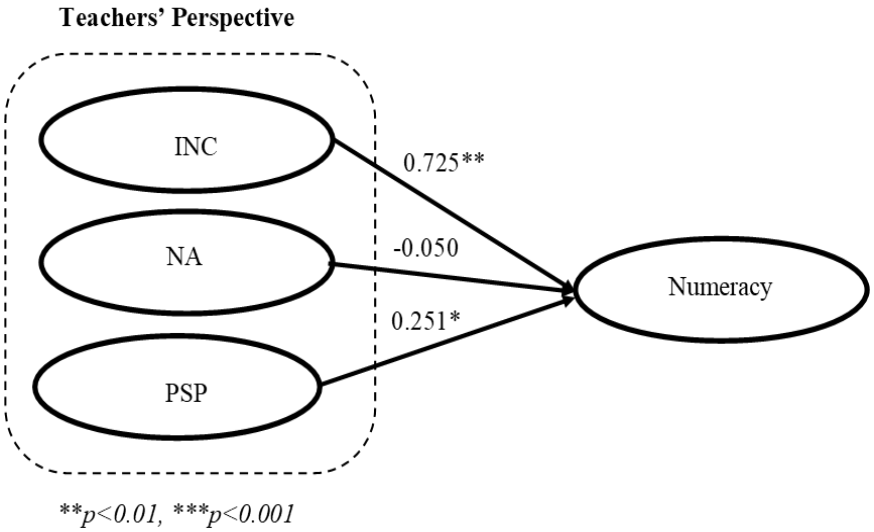

Figure 1. Multiple regression test results

The results of the multiple regression analysis in Figure 1 show that INC had a positive and significant influence on students' numeracy development, with a regression coefficient of 0.725 and a p-value <0.01. Therefore, the implementation of INC was correlated with a significant effect on students' numeracy skills, showing that INC provided a practical framework for numeracy skills development. The practical framework in the

study referred to a structured plan or guideline for instructional methods and strategies in INC that had been statistically proven to have a positive and significant effect on students' numeracy skills.

Figure 1 also shows that NA had no significant effect on students' numeracy development, with a regression coefficient of -0.050. The negative value showed that, from teachers' perspectives, the implementation of NA did not significantly impact students' numeracy skills. Teachers questioned the effectiveness of NA in empowering students' numeracy skills and perceived its effects did not fully meet expectations. Although NA was effective as a diagnostic tool for evaluating and measuring students' numeracy skills, it did not significantly affect to their development.

The PSP program, as shown in Figure 1, had a positive and significant influence on students' numeracy development, with a regression coefficient of 0.251 and p-value <0.05. Therefore, the implementation of the PSP was correlated with an increase in students' numeracy skills. Teachers believed that the values taught in PSP, such as critical thinking, creativity, and collaboration, strongly supported the development of the skills. Based on the research, the PSP projects encouraged students to think critically by planning and identifying alternative solutions. Students were not only required to comprehend mathematical procedures but also the concepts and be able to interpret data intensively and critically. This critical thinking aspect was crucial in strengthening students' numeracy competencies across various life contexts.

Teachers perceived that the PSP projects supported students' creativity in utilizing numbers and estimation, generating original ideas and works, and solving problems with innovative solutions. These activities required numeracy not only as counting skills but also as a creative tool for planning, estimating, executing, and developing ideas. The program also facilitated projects for students to collaborate with their peers. By collectively working on projects, students deepened their understanding of numeracy concepts by exchanging ideas and exploring different problem-solving methods. Teachers recognized the importance of Pancasila values in forming students who were academically intelligent and had strong character. Furthermore, the PSP programs were designed to shape students' character based on Pancasila values, including the development of numeracy competencies.

Table 6. ANOVA table

Sum of Regression		**df**	**Mean Square**	***F***	**Sig.**
Regression	30.860	3	10.287	62.892	<0.001
Residual	30.750	188	0.164		
Total	61.611	191			

The ANOVA in Table 6 shows that the significance value in the F test was less than 0.05, with a calculated F value = 62.892 > F table = 2.65. Therefore, INC, NA, and PSP collectively influenced numeracy development.

Table 7. Model summary

R	***R Square***	***Adjusted R Square***	**Std. Error of the Estimate**
0.708	0.501	0.493	0.40443

The model summary in Table 7 shows a coefficient of determination or R Square value of 0.501. This showed that INC, NA, and PSP collectively influenced numeracy development by 50.1%.

Most teachers believed that INC and its programs represented a significant and positive change in Indonesian education. This was evidenced by the increase in numeracy achievements of Indonesian students reported at NA from 2022 to 2023, namely 16.01% for elementary school level, 3.79% for junior high school level, and 5.98% for senior high school level, as stated in Table 8 (Ministry of Education and Culture of the Republic of Indonesia, 2023).

Table 8. Results of numeracy achievements for the last two years

Year		Numeracy achievement results (%)		
Implementation of NA	**Release Report**	**Elementary school**	**Junior high school**	**Senior high school**
2021	2022	30.66	36.84	35.16
2022	2023	46.67*	40.63*	41.14*

*Increment in numeracy result

Phase 2: Qualitative Study

***RQ2**: What are the perceptions and challenges faced by mathematics teachers in developing students' numeracy skills when implementing INC and its programs?*

This qualitative study explored the results of open-ended questionnaires and one-on-one interviews, focusing on the perceptions and challenges faced by mathematics teachers with the implementation of INC and its programs. Based on the quantitative phase, the majority of Indonesian mathematics teachers responded positively to the effectiveness of INC and its programs in supporting numeracy skills. Some believed that INC and its supporting programs provided sufficient support and autonomy for designing mathematics learning and developing students' numeracy skills. Teachers focused on students' progress, potential, and competencies at each phase because the instructional content and material in INC were designed to be simpler but more contextualized for learning.

A teacher remarked, *"I believe that INC is effective since it provides support and autonomy for me as a teacher to design mathematics learning and introduce students to numeracy problems in a daily context. The instructional content and material are now simpler and more related to daily context, hence, we focus on students' progress, potential, and competencies"*.

Another teacher emphasized the benefits of NA as a supporting program of INC for numeracy skills development. Students were also observed to be regularly exposed to numeracy problems and real-world situations, honing their ability to understand, use, and communicate numerical information in daily contexts. This benefit extends not only to mathematics but also across the broader curriculum. In addition, positive perceptions of PSP in INC were also reported. Teachers found that the numeracy projects allowed students to express ideas in both oral and written forms. These projects challenged students to become

productive individuals capable of solving mathematical and non-mathematical problems effectively, thereby developing into effective problem solvers.

According to mathematics teachers, there are three key aspects of PSP that support numeracy, namely critical thinking, creativity, and collaboration. The projects implemented in PSP facilitate students to think critically by planning and identifying alternative solutions to challenges. Students are not only required to understand mathematical procedures but also understand why and how these concepts are applied, and be able to interpret data and information intensively. This critical thinking aspect plays a crucial role in strengthening students' numeracy competencies across various life contexts.

Numeracy is supported through the creative aspect of PSP. Students are encouraged to use numbers and estimation to produce tangible products, such as crafts based on geometry or other outputs. These activities require numeracy not only as a counting skills but also as a creative tool for planning, estimating, executing, and developing ideas. The results also showed the importance of collaboration in PSP for developing numeracy skills. The program facilitated students to collaborate with peers and take responsibility for achieving an objective. By collectively working on a project, students deepened their understanding of numeracy concepts by exchanging ideas and exploring different problem-solving methods. This collaboration process not only improves students' comprehension of numeracy concepts but also help develop critical thinking and communication skills.

Approximately 10% of respondents disagreed with the effectiveness of INC and its programs in supporting numeracy. Teachers reported that similar cognitive aspects, such as those emphasized in PSP for skills like numeracy, had already been introduced and implemented in previous Indonesian curriculums. INC continued these programs with a new emphasis on flexibility and autonomy for teachers and schools in developing the skills. However, some teachers perceived INC to be impractical because of the lack of theoretical guidance for mathematics learning. Teachers tended to make personal interpretations of how to implement mathematics learning under the pretext of flexibility and autonomy, resulting in undirected learning.

Some teachers expressed concerns about NA as a diagnostic tool. NA was also claimed to be ineffective for assessing and developing students' cognitive abilities, specifically numeracy skills, due to unrepresentative samples and varying characteristics of students across different schools. Only students involved in NA tests are actively engaged in learning. Furthermore, NA could not be used as a reliable benchmark for assessing cognitive development.

A teacher remarked, *"In my opinion, the implementation of NA is not effective for cognitive assessment and development because the samples are not representative, and the characteristics of students in each school are different. Only students who take NA tests engage in learning"*.

Teachers who disagreed regarding the implementation of projects in PSP stated that mathematics learning, specifically at the elementary level, did not require projects because students needed a comprehensive concept understanding. The focus on project implementation left some students struggling to understand the basic mathematics concepts, leading to low numeracy skills and misconceptions for students at subsequent levels.

These results showed both the supportive and opposing views of teachers regarding INC and its programs. Despite the majority of teachers holding positive perceptions of INC and its programs in developing numeracy, there were still challenges in implementation. A comprehensive evaluation is needed to identify the gaps between teachers' perceptions and NA results presented in Indonesian Education Report Card (Ministry of Education and Culture of the Republic of Indonesia, 2023). It shows relatively low scores for numeracy achievement during the implementation of NA. Despite the increase in these scores as depicted in Table 8, the minimum success rate of 50% was not reached. Furthermore, this phase identifies the challenges encountered by mathematics teachers in developing numeracy skills within INC and its supporting programs, namely NA and PSP, using a thematic deductive approach. These challenges were consecutively classified into three themes. These themes are challenges of implementing INC, NA, and PSP.

Theme 1: Challenges of Implementing INC

This study found that mathematics teachers in remote schools or far from city centers encountered various challenges in accessing information and obtaining adequate infrastructure to support the learning process and numeracy development. Teachers were unable to present a visualization of graphs, diagrams, and pictures due to inadequate tools and unreliable electricity.

Teachers remarked, *"Our school is far from city centers, hence, we face challenges in conducting proper mathematics learning to facilitate numeracy development due to limited infrastructure, access to information, and skilled school staff. Numeracy problems often involve graphs, diagrams, and pictures, but we ironically cannot present PowerPoint slides or other teaching materials because of uneven electricity resources at our school"*.

The lack of skilled resources in utilizing technology for numeracy learning was identified as another significant challenge. Senior mathematics teachers, in particular, often lacked training in using advanced technology for mathematics learning. Many expressed the need for workshops to develop technical skills.

A teacher stated, *"I have been a senior mathematics teacher for over 25 years, but I am not skilled enough to independently use advanced tools or technology. I think a mini-workshop to learn the basics of technical issues is needed for me and other senior teachers. I often rely on younger teachers to help me set up the classroom, but I prefer to not use those things in teaching rather than burdening others"*.

Remote schools faced an additional challenge of limited socialization among teaching staff regarding numeracy skills development. Therefore, teachers in remote schools had to learn independently about improving numeracy without any direct guidance from professional staff through outreach or training.

Teachers in urban schools faced different challenges, particularly with students' behavior related to gadget use, especially cell phones in the school environment. Students often lacked focus on the given instruction. This behavior hampers the focus on completing the numeracy tasks, resulting in suboptimal development of numeracy skills because valuable learning time is wasted on unproductive activities.

Teachers reported that the flexibility method in INC created an imbalance in how the material is adapted and taught. For instance, some grade 7 students may only be introduced to a small portion of the curriculum as the teachers only focus on mastering specific topics. As a result, materials not covered in grade 7 should be deferred to grade 8 or 9. This can leave students with a weak foundation in mathematical concepts, making the subsequent materials in grade 8 or 9 more challenging and overwhelming. Also, students' understanding of numeracy may become shallow and inconsistent.

A teacher asserted, *"As an eighth-grader teacher, one of the challenges I face is re-teaching mathematics concepts because the materials taught by different teachers are often unbalanced due to the flexibility of the curriculum"*.

Another issue is the lack of coordination between mathematics teachers across different grade levels, which results in gaps in the curriculum. This approach makes it difficult for students to bridge the gap between grade levels, as the transition from one grade to the next needs to be better integrated. The imbalance in material coverage and lack of coordination among mathematics teachers disrupt the continuity of learning. Poorly coordinated learning experiences hinder the sustainable and comprehensive development of numeracy skills. This also triggers students' difficulties in connecting previously learned concepts with new material, impairing the ability to build strong numeracy skills in an integrated and continuous manner.

Theme 2: Challenges of Implementing NA

Teachers were initially very enthusiastic about implementing numeracy concepts in class, hoping that students would become proficient in solving numeracy problems and achieve good results in NA. However, in practice, teachers believe that follow-up on NA results is lacking and need clear information, feedback, or direction on how to use NA results when teaching. This can lead to difficulties in identifying students' specific weaknesses in numeracy due to the limited information, preventing the ability to provide targeted support. This leads to undirected learning as teachers lack guidelines for continuing the numeracy learning process. As a result, initial efforts to improve students' understanding of numeracy did not have a significant impact due to the lack of guidance on interpreting and integrating NA results into mathematics learning.

A teacher remarked, *"I was initially enthusiastic about the national assessment as it evaluates literacy and numeracy skills, but I was really disappointed that there was no follow-up on NA results. I could not identify my students' weaknesses in numeracy and mathematics learning since I honestly lacked information about the result"*.

"I believe NA aims to identify students' learning needs, development, and achievement of outcomes. Unfortunately, NA has not been used as feedback for improving learning, as it has not been optimized in practice".

Mathematics teachers in rural areas report that NA does not accurately measure students' cognitive achivement and character. NA has not effectively evaluated and mapped aspects that support the quality of learning within the school environment. The teacher stated that students consider NA as an optional program since the results do not directly impact grade promotion. Students' perception regarding NA as a formality program decreases

students' motivation to learn and practice numeracy, hindering the development of solid and sustainable numeracy skills.

A teacher stated, *"NA does not fully measure students' cognitive abilities or character, specifically in rural schools like ours, where its implementation seems more like a formality"*.

"NA has not supported numeracy skills development in mathematics learning because students underestimate it, knowing it does not affect graduation or class promotion".

Teachers stated that students were not prepared for NA, as the curriculum change was considered sudden, and were not accustomed to solving mathematics problems related to real-life, socio-cultural, and scientific contexts. Without adequate preparations for these changes, students' understanding of numeracy concepts was compromised. Students also struggled to follow lessons and engage actively in discussions and numeracy exercises.

A teacher stated, *"Many students are not ready for NA because the curriculum change was sudden, and they are not used to solving numeracy problems"*.

Theme 3: Challenges of Implementing PSP

One of the main challenges is teachers' misconception that PSP should be implemented on a large scale and requires substantial funding. This perception has led some schools to hesitate to fully adopt the programs. Furthermore, the perception that PSP should result in tangible products increases teachers' workload. These hesitations hinder the numeracy skills projects in schools, as added pressures reduce motivation and divert attention from numeracy instruction.

A teacher explained, *"A large-scale project to produce a tangible product cannot be implemented in our school since we do not have a sufficient budget to promote numeracy skills development as intended by INC program in PSP, along with increased workloads for teachers"*.

Many mathematics teachers face significant challenges in implementing PSP, which impacts INC programs in general, particularly in remote schools with limited facilities and access to information. These schools often lack adequate learning media, internet access, and classroom resources, hindering the effectiveness of PSP and its numeracy programs.

Another challenge is students' selfish behavior, which undermines the objective of cultivating mutual cooperation in PSP program. Although PSP is designed to foster collaboration, excessive independence can hinder this objective. When individual achievements are prioritized, students miss the opportunities to practice and internalize the values of mutual cooperation. Students used to working independently may become selfish and less capable of collaborating with their peers.

A teacher remarked, *"Although students have become independent through PSP program, they still tend to act selfishly, unable to collaborate with peers as they believe in the ability to complete numeracy projects and other tasks individually. Our challenge is to redesign learning and projects for students to develop both independence and collaborative skills"*.

Time management is another challenge reported by mathematics teachers. Implementation PSP requires allocating time efficiently and designing mathematics learning that instills numeracy concepts without disrupting other learning activities. The presence of various extracurricular activities and supporting agendas often causes teachers to procrastinate PSP implementation.

A teacher stated, *"My difficulty lies in managing my time efficiently and designing numeracy learning, as there are many other extracurricular activities"*.

3.2. Discussion

The implementation of INC and its supporting programs provided educators with the freedom and autonomy to adapt teaching methods to students' needs, determine relevant curriculum based on local requirements, develop character, and strengthen students' competence (Taufik & Rindanigsih, 2024). The quantitative phase of this study concluded that Indonesian mathematics teachers had a positive view of the effectiveness of INC and its implementation programs in supporting numeracy skills development, with the exception of NA programs. Despite the increase in NA scores, the results were still relatively low (Purnomo et al., 2023; Sa'dijah et al., 2023; Yerizon et al., 2024). Previous studies also showed that students in certain regions of Indonesia struggled with numeracy problems (Dewantara et al., 2023; Hidayah et al., 2022). These results showed the need for further evaluation to understand the challenges teachers faced in developing numeracy through NA program. Despite acknowledging the significance of INC and PSP in developing numeracy, teachers still experienced challenges in implementation. The study identified the gaps between teachers' perceptions and NA results presented in the Indonesian Education Report Card.

The first theme of this current study identified several challenges faced by mathematics teachers in Indonesia. The first challenge identified in implementing INC is challenges in accessing information and obtaining adequate infrastructure to facilitate the learning process. It corresponded with the previous study that infrastructure is crucial in learning (Imelda et al., 2023). Limited internet access in remote areas prevented teachers and students from utilizing digital learning sources for numeracy skills enhancement (Sukmayadi & Yahya, 2020). Previous studies stated that elementary school teachers in remote areas faced similar challenges, including unstable internet access and a lack of technological devices (Supriatna et al., 2023). The cultivation of numeracy skills in INC was challenged by infrastructure limitations, such as inadequate classrooms and limited teaching materials (Fannisa et al., 2023). The lack of technological devices, such as computers or tablets, made it difficult for teachers to integrate technology into numeracy learning (Igcasama et al., 2023; Yamtinah et al., 2022). It was easier for teachers to create a conducive learning environment for numeracy development with adequate facilities (Miller, 2018).

The lack of skilled resources in utilizing technology was another significant challenge in implementing INC. According to previous studies, some mathematics teachers in Indonesia were not skilled in implementing ICT-based learning (Mkhize & Davids, 2023; Wijaya et al., 2024). Technology could help visualize abstract concepts and provide interactive exercises crucial for improving students' numeracy skills (Miller, 2018).

However, the teachers often repeat material from the notes without further development and use simple types of problems that do not encourage students to think logically (Fannisa et al., 2023). To effectively instill numeracy skills in students, teachers also need to be skilled. Implementing contextual learning by skilled teachers could help students better understand and apply mathematical concepts in everyday life (Iswara et al., 2022).

Mathematics teachers in remote schools faced the additional challenge of a lack of socialization among teaching staff during the implementation of INC. Previous studies showed that over 78% of teachers struggled to develop numeracy test instruments due to the new numeracy assessment in the Indonesian curriculum (Purnomo et al., 2022). Socialization and technical guidance regarding the implementation of INC have been suboptimal, leading to limited knowledge regarding the cultivation of numeracy in INC (Supriatna et al., 2023). This challenge was not unique to Indonesia, as teachers in Malaysia also needed to choose materials corresponding with students' needs and interests and adjust syllabus content, methods, approaches, and teaching techniques accordingly to develop numeracy skills effectively (Md-Ali et al., 2016).

Teachers in urban schools often faced students' behavior related to gadget use when implementing INC to improve numeracy skills. Phubbing, the act of ignoring teachers or classmates in social situations, such as studying and discussing, by focusing on a cell phone, is a common issue (Uğur & Koç, 2015). When teachers assign tasks or numeracy projects that involve using cell phones, students often misuse the gadgets for purposes unrelated to the assignments, such as playing games or communicating with friends, instead of focusing on the tasks (Tindell & Bohlander, 2012). Therefore, the use of technology in cultivating numeracy in urban schools still faces challenges related to students' behavior.

INC provides flexibility and autonomy for teachers to design mathematics learning that suits students' abilities and fosters the application of numeracy in daily life (Taufik & Rindanigsih, 2024). The flexibility and autonomy aspects of INC offer an imbalance in how the material is adapted and taught. In addition, a lack of coordination between mathematics teachers across different grade levels was identified as a challenge in implementing INC (Akib et al., 2020). This approach makes it difficult for students to bridge the gap between grade levels, as the transition from one grade to the next needs to be better integrated.

The second theme focuses on the challenges faced by mathematics teachers in implementing NA program. Lack of guidance on interpreting and integrating NA results into mathematics learning was classified as one of the challenges. In addition, the lack of accurate NA data makes it difficult for educators to improve numeracy skills appropriately (Yamtinah et al., 2022). This incomplete evaluation is a significant challenge to improving the quality of learning. NA's inability to measure and map the quality of learning in various school contexts, especially in remote areas, exacerbates educational disparities. Students in these areas need more attention and intervention to improve numeracy skills (Santillan, 2023). This differs from the challenges of the previous curriculum, where national exams focused only on results and overlooked the learning process because it focused on students' grade promotion and graduation (Akib et al., 2020).

NA program was viewed by students as a mere formality program. NA struggles to showcase students' cognitive achievements, and students tend to consider it optional as the

results do not directly impact graduation or grade promotion (Werang, 2023). As supported by previous studies, application of NA is often considered a mere formality that fails to provide a comprehensive picture of students' overall abilities (Rahman et al., 2021).

Previous curriculum changes show that teachers' mindsets were not prepared for such reform (Akib et al., 2020; Lidinillah et al., 2022; Sukmayadi & Yahya, 2020; Wijaya et al., 2024). The shift from a teacher-centered to a student-centered learning approach requires significant time and adaptation (Rizki & Fahkrunisa, 2022). The changes force students out of their comfort zones (Ellen & Sudimantara, 2023), as those who are used to receiving information passively from teachers are expected to participate actively and critically in lessons. Although numeracy learning requires a deep understanding and the ability to apply mathematical concepts independently, students are not used to solving mathematics problems related to daily, socio-cultural, and scientific contexts (Genc & Erbas, 2019).

The third theme discusses the challenges in PSP implementation. The misconceptions that PSP should be implemented on a large scale with substantial funding hindered students' improvement of numeracy skills. These perceptions were also reported in a previous study (Agung et al., 2022). Another perception that PSP should lead to tangible products also hindered numeracy skills development. Therefore, producing materials increased the workloads of teachers, who were already overwhelmed with teaching and administrative duties (Afutor, 2020). Teachers spend more time designing complex projects rather than developing effective methods for teaching numeracy (Boss & Larmer, 2018).

Schools need to pay more attention to effective PSP initiatives that could be executed with minimal resources (Anbiya et al., 2023). Focusing on the final product can divert attention from the main objective of PSP, namely developing students' character and basic skills, including numeracy (Mulyadi & Mardiana, 2022). Simple and creative projects could actually be implemented to strengthen students' skills without incurring significant costs by utilizing available resources and a budgeting planner (Khatib et al., 2022). The project in PSP encourages continuous learning and be relevant to everyday life, not just the creation of physical products (Ngereja et al., 2020).

This study found a challenge regarding facilities limitations in implementing PSP. The lack of facilities specifically hampered students' opportunities to develop numeracy skills (Fannisa et al., 2023), increasing the achievement gap between students in remote and urban areas. This was similar to the constraints faced by INC (Imelda et al., 2023). PSP principle shows that students' freedom to learn and be creative requires adequate support and infrastructure (Taufik & Rindanigsih, 2024).

Students' selfish behavior is a significant challenge for implementing PSP. This could abate the cultivation of numeracy in PSP program implementation or hinder opportunities to learn from one another, share problem-solving strategies, and collectively generate creative and innovative solutions. Mutual cooperation is an important aspect of Indonesian culture that should be taught and practised in schools (Saidek et al., 2016). According to previous studies, mutual cooperation (Anwar et al., 2024) and group collaboration are essential for facilitating discussions and the exchange of ideas that enrich the understanding of numeracy. Enhancing numeracy skills is not only about understanding mathematical concepts but also the application in real-world situations that often require

collaboration. The lack of experience in collaborative problem-solving can limit the abilities of students to address numeracy challenges that require teamwork (Kruger & Yorke, 2010; Lehane & Senior, 2020).

This study identified a challenge regarding time management in learning and PSP project time. The preparation of materials and resources demands sufficient time, from preparing lesson notes to figuring out appropriate resources in order to support numeracy skills (Bezanilla et al., 2021). Furthermore, schools often have many extracurricular activities and events that coincide with PSP time (Zakso et al., 2022). In general, time constraints are a crucial factor that needs to be considered in planning and implementing numeracy skills in PSP implementation (Akib et al., 2020).

4. CONCLUSION

The findings of the first phase of quantitative analysis deduced that most of the mathematics teachers in Indonesia had a positive perception regarding the effectiveness of INC and the supporting programs, such as NA and PSP, in enhancing numeracy skills. Multiple regression showed that the implementation of INC and PSP significantly influenced numeracy skills. However, NA was found to only evaluate and measure the numeracy skills of students without making a significant effect to their development.

In the qualitative phase, various challenges in cultivating numeracy were identified not only in the application of NA but also in INC and PSP. The first challenge encountered in embedding numeracy in INC implementation was geographical location and resource limitations. Schools in remote areas often encountered difficulties accessing information and obtaining adequate infrastructure to support the learning process. The lack of skilled resources in utilizing technology was another significant challenge in implementing INC. The second challenge encountered was the lack of socialization and training for teachers in remote regions. The third challenge was the behavior of students concerning the use of technology. The final challenge was material inconsistency and a lack of coordination between grade levels. The INC granted teachers considerable freedom but established a lack of coordination across different grades, resulting in material imbalances.

Instilling numeracy skills through the implementation of NA included some challenges, such as a lack of follow-up directions, perceptions of NA formality, and unpreparedness of students. A lack of follow-up directions and unclear information related to NA result led to undirected learning, reducing the understanding of skills. The lack of accurate NA data also made it difficult for mathematics teachers to adopt appropriate enhancement and provide specific support to students. Furthermore, NA was often viewed as a mere formality without providing a comprehensive overview of students' abilities. Students who did not consider NA significant showed low learning motivation, which reduced the enhancement of sustainable numeracy skills. Moreover, students needed to prepare for NA due to sudden changes in curriculum. The shift of focus from teacher to student-centered learning required significant adaptation. While students were unprepared for this transition, their understanding of numeracy concepts could be compromised, making it difficult to follow lectures and participate in discussions and numeracy exercises.

Perceptions of high implementation costs and tangible product, limited facilities, selfish behavior, time management, and resources were identified as the challenges encountered in embedding numeracy into PSP. The perception that PSP should be implemented at high costs has reduced the interest of some schools in adopting the programs. The assumption of producing a tangible product and complex project also hesitate mathematics teachers in implementing it. Limited supporting facilities to conduct a project were a constraint for some remote schools. Another challenge was students' independence and selfish behavior, as independence in PSP could result in selfish behavior, abating the development of mutual cooperation. The lack of cooperation in collaborative problem-solving limited the abilities to address numeracy tasks that required teamwork, while the final challenge was time, materials, and resources. The preparation of materials and resources required sufficient time, from assembling the lesson notes to figuring out the right resources to enhance numeracy skills.

The challenges provided insight into the difficulties teachers and students encountered in enhancing numeracy skills. This study's implications required more intensive and continuous professional training and development for teachers to understand better and effectively implement INC and the supporting programs. The provision of adequate facilities and resources was crucial to supporting the implementation of the programs. The government and relevant parties should ensure that all schools have adequate access to technology and educational resources. Furthermore, the government and policymakers should continue to evaluate and adapt INC and its programs based on teachers' input and students' learning outcomes to ensure that the curriculum effectively supports numeracy skills development.

Declarations

Author Contribution : IRH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, and Writing - original draft; CS: Investigation, Resources, Project administration, Writing - review & editing, Funding acquisition, and Supervision; LA: Methodology, Data curation, Writing - review & editing, and Supervision; Y: Validation, Visualization; IMA: Validation, and Visualization.

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REFERENCES

Abella, J., Kilag, O. K., Andrin, G., Tañiza, F. N., Groenewald, E., & Cordova Jr, N. (2024). Benchmarking literacy and numeracy: The contributing elements. *Excellencia: International Multi-disciplinary Journal of Education*, *2*(1), 90-99.

Abidin, D., Retnaningrum, E., Parinussa, J. D., Kuning, D. S., Manoppo, Y., & Kartika, I. M. (2023). Curriculum development in Indonesia from a historical perspective. *Journal of Education Research*, *4*(2), 443-451.

Afutor, P. (2020). ICT infrastructure, ICT competencies, and teachers' workload: Critical factors that influence social studies teachers' integration of technology in the Kwahu west municipality of ghana. *Journal of Education and Practice*, *11*(14), 65-75.

Agung, I., Subijanto, S., Wirda, Y., Sofyatiningrum, E., Listiawati, N., & Widodo, W. (2022). Teachers' perceptions of the influence of "Mover School" in generating Pancasila student profiles. *Journal of Positive Psychology and Wellbeing*, *6*(2), 314–328.

Akib, E., Imran, M. E., Mahtari, S., Mahmud, M. R., Prawiyogy, A. G., Supriatna, I., & Ikhsan, M. H. (2020). Study on implementation of integrated curriculum in Indonesia. *IJORER: International Journal of Recent Educational Research*, *1*(1), 39-57. https://doi.org/10.46245/ijorer.v1i1.24

Amin, T. S., Meisuri, M., Zulfitri, Z., Nurlaili, N., & Harahap, Y. S. (2023). Analyzing teachers' perception on the implementation of the assessment process in merdeka curriculum. *International Journal of Educational Research Excellence (IJERE)*, *2*(2), 665-673. https://doi.org/10.55299/ijere.v2i2.731

Anbiya, B. F., Budimansyah, D., Maftuh, B., & Sari, K. K. (2023). Analysis of PROSPER strategy in the implementation of the Pancasila student profile strengthening project in senior high school. *Journal La Sociale*, *4*(5), 238-249. https://doi.org/10.37899/journal-la-sociale.v4i5.890

Anwar, L., Sa'dijah, C., & Murtafiah, W. (2024). The effect of peer review on the quality of developed numeracy problems: The case of Indonesian mathematics teacher candidates. *AIP Conference Proceedings*, *3049*(1). https://doi.org/10.1063/5.0194846

Bezanilla, M. J., Domínguez, H. G., & Ruiz, M. P. (2021). Importance and possibilities of development of critical thinking in the university: The teacher's perspective. *REMIE: Multidisciplinary Journal of Educational Research*, *11*(1), 20-48. https://doi.org/10.17583/remie.0.6159

Boss, S., & Larmer, J. (2018). *Project based teaching: How to create rigorous and engaging learning experiences*. ASCD.

Callingham, R., Beswick, K., & Ferme, E. (2015). An initial exploration of teachers' numeracy in the context of professional capital. *Zdm*, *47*, 549-560. https://doi.org/An initial exploration of teachers' numeracy in the context of professional capital

Campbell-Phillips, S. (2020). Education and curriculum reform: The impact they have on learning. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *3*(2), 1074-1082. https://doi.org/10.33258/birle.v3i2.1036

Chamisijatin, L., Pantiwati, Y., Zaenab, S., & Aldya, R. F. (2023). The implementation of projects for strengthening the profile of Pancasila students in the implementation of

the independent learning curriculum. *Journal of Community Service and Empowerment*, *4*(1), 38-48. https://doi.org/10.22219/jcse.v4i1.24679

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*. Routledge. https://doi.org/10.4324/9780203224342

Cordova Jr, N., Kilag, O. K., Andrin, G., Tañiza, F. N., Groenewald, E., & Abella, J. (2024). Leadership strategies for numeracy development in educational settings. *Excellencia: International Multi-disciplinary Journal of Education*, *2*(1), 58-68.

Dewantara, A. H., Setiawati, F. A., & Saraswati, S. (2023). Towards numeracy literacy development: A single-case study on the use of the living book homeschooling model. *Infinity Journal*, *12*(2), 225-242. https://doi.org/10.22460/infinity.v12i2.p225-242

Dorris, C., Winter, K., O'Hare, L., & Lwoga, E. T. (2021). PROTOCOL: A systematic review of mobile device use in the primary school classroom and its impact on pupil literacy and numeracy attainment. *Campbell Systematic Reviews*, *17*(2), e1155. https://doi.org/10.1002/cl2.1155

Ellen, K. K., & Sudimantara, L. B. (2023). Examining emancipated curriculum development in middle schools: A case study. *PANYONARA: Journal of English Education*, *5*(2), 165-188. https://doi.org/10.19105/panyonara.v5i2.8779

Fannisa, A. A., Anggraini, D., Romdani, K. N., & Dewi, M. T. (2023). The challenges of learning social science in the "Merdeka" curriculum in elementary schools. *MANDALIKA : Journal of Social Science*, *1*(2), 52-59. https://doi.org/10.56566/mandalika.v1i2.117

Forgasz, H. J., Leder, G., & Hall, J. (2017). Numeracy across the curriculum in Australian schools: Teacher education students' and practicing teachers' views and understandings of numeracy. *Numeracy*, *10*(2), 2. https://doi.org/10.5038/1936-4660.10.2.2

Gayo, A. I. P. (2018). Teacher strategies in realizing the Pancasila student profile through mathematics learning in elementary schools. *Tekno - Pedagogi : Jurnal Teknologi Pendidikan*, *8*(2), 19-25. https://doi.org/10.22437/teknopedagogi.v8i2.32768

Geiger, V., Forgasz, H., & Goos, M. (2015). A critical orientation to numeracy across the curriculum. *Zdm*, *47*(4), 611-624. https://doi.org/10.1007/s11858-014-0648-1

Geiger, V., Goos, M., & Forgasz, H. (2015). A rich interpretation of numeracy for the 21st century: a survey of the state of the field. *Zdm*, *47*(4), 531-548. https://doi.org/10.1007/s11858-015-0708-1

Genc, M., & Erbas, A. K. (2019). Secondary mathematics teachers' conceptions of mathematical literacy. *International Journal of Education in Mathematics, Science and Technology*, *7*(3), 222-237.

Goos, M., Geiger, V., & Dole, S. (2012). Auditing the numeracy demands of the middle years curriculum. *Pna*, *6*(4), 147-158. https://doi.org/10.30827/pna.v6i4.6138

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. SAGE.

Gurion, S. B. (2024). Teacher readiness in implementing "the merdeka curriculum". *Journal of Education and Teaching (JET)*, *5*(1), 108-118. https://doi.org/10.51454/jet.v5i1.321

Hidayah, I. R., Kusmayadi, T. A., & Fitriana, L. (2021a). E-book based on local wisdom to improve students' numeracy skill: Is it effective? In *International Conference of Mathematics and Mathematics Education (I-CMME 2021)*, (pp. 142-147). https://doi.org/10.2991/assehr.k.211122.020

Hidayah, I. R., Kusmayadi, T. A., & Fitriana, L. (2021b). Minimum competency assessment (AKM): An effort to photograph numeracy. *Journal of Mathematics and Mathematics Education*, *11*(1), 14-20. https://doi.org/10.20961/jmme.v11i1.52742

Hidayah, I. R., Kusmayadi, T. A., & Fitriana, L. (2022). Students' difficulties in implementing numerical literacy in Cirebon local wisdom-oriented problem solving. *AIP Conference Proceedings*, *2566*(1). https://doi.org/10.1063/5.0116681

Igcasama, R., Kilag, O. K., Cabonilas, L., Abarias, C. M., Abendan, C. F., & Bubuli, A. L. (2023). Enhancing numeracy: A technological approach to improve basic math skills. *Excellencia: International Multi-disciplinary Journal of Education*, *1*(6), 455-464.

Imelda, I., Nasution, B., Hasmin, E., Aini, N., & Manu, C. M. A. (2023). Pedagogical evolution: The curriculum revolution as a pinnacle transformation unveiling unprecedented innovation In Indonesia's educational fabric. *IJGIE (International Journal of Graduate of Islamic Education)*, *4*(2), 399-411. https://doi.org/10.37567/ijgie.v4i2.2588

Indra, A. D., & Budimansyah, D. (2020). Implementation of Pancasila values in improving nationalism for young generation. In *2nd Annual Civic Education Conference (ACEC 2019)*, (pp. 73-76). https://doi.org/10.2991/assehr.k.200320.014

Iswara, H. S., Ahmadi, F., & Da Ary, D. (2022). Numeracy literacy skills of elementary school students through ethnomathematics-based problem solving. *Interdisciplinary Social Studies*, *2*(2), 1604-1616. https://doi.org/10.55324/iss.v2i2.316

Khatib, M. E., Alhosani, A., Alhosani, I., Matrooshi, O. A., & Salami, M. (2022). Simulation in project and program management: Utilization, challenges and opportunities. *American Journal of Industrial and Business Management*, *12*(4), 731-749. https://doi.org/10.4236/ajibm.2022.124037

Kruger, D., & Yorke, C. (2010). Collaborative co-teaching of numeracy and literacy as a key to inclusion in an independent school. *South African Journal of Education*, *30*(2), 293-306. https://hdl.handle.net/10520/EJC32230

Kurniawan, M. I. (2018). Pancasila as a basis for nation's character education. In *1st International Conference on Intellectuals' Global Responsibility (ICIGR 2017)*, (pp. 268-270). https://doi.org/10.2991/icigr-17.2018.64

Lehane, P., & Senior, J. (2020). Collaborative teaching: Exploring the impact of co-teaching practices on the numeracy attainment of pupils with and without special educational needs. *European Journal of Special Needs Education*, *35*(3), 303-317. https://doi.org/10.1080/08856257.2019.1652439

Lidinillah, D. A. M., Rahman, R., Wahyudin, W., & Aryanto, S. (2022). Integrating sundanese ethnomathematics into mathematics curriculum and teaching: A systematic review from 2013 to 2020. *Infinity Journal*, *11*(1), 33-54. https://doi.org/10.22460/infinity.v11i1.p33-54

Maryani, Y. (2023). Learning centered on the creativity of group B students in the implementation of kurikulum merdeka. *Jurnal Pendidikan Profesi Guru*, *1*(1), 34-42.

Mason, J., Khan, K., & Smith, S. (2016). Literate, numerate, discriminate: realigning 21st century skills". In *Proceedings of the 24th International Conference on Computers in Education*, Bombay, Nov. 28–Dec. 2, 2016 (pp. 609-614).

Md-Ali, R., Karim, H. B. B. A., & Yusof, F. M. (2016). Experienced primary school teachers' thoughts on effective teachers of literacy and numeracy. *Malaysian Journal of Learning and Instruction*, *13*(1), 43-62.

Miller, T. (2018). Developing numeracy skills using interactive technology in a play-based learning environment. *International journal of STEM education*, *5*(1), 39. https://doi.org/10.1186/s40594-018-0135-2

Ministry of Education and Culture of the Republic of Indonesia. (2023). *Rapor Pendidikan Indonesia [Indonesian Education Report Card]*. Ministry of Education and Culture of the Republic of Indonesia.

Mkhize, T. R., & Davids, M. N. (2023). Resources mobilisation challenges in rural schools of South Africa: What can we learn? *Multidisciplinary Journal of Educational Research*, *13*(3), 295-312. https://doi.org/10.17583/remie.9311

Mulyadi, D., & Mardiana, R. (2022). Sekolah penggerak: Does curriculum design made fit with the program? *Adpebi International Journal of Multidisciplinary Sciences*, *1*(1), 400-414.

Nasution, I. N., & Indrasari, S. Y. (2024). Twenty years of change: A systematic literature review of Indonesian teachers' responses to curriculum change. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *10*(1), 100-112. https://doi.org/10.33394/jk.v10i1.10633

Ngereja, B., Hussein, B., & Andersen, B. (2020). Does Project-Based Learning (PBL) Promote Student Learning? A Performance Evaluation. *Education Sciences*, *10*(11), 330. https://doi.org/10.3390/educsci10110330

Novita, M., Kusumaningsih, W., Wardana, Y. S., Behera, S. K., Mujiono, M., & Iskandar, F. (2022). Advancing Indonesian education through the three penggerak programs. *KnE Social Sciences*, *7*(19), 421-431. https://doi.org/10.18502/kss.v7i19.12462

Oktiningrum, W., Zulkardi, Z., & Hartono, Y. (2016). Developing PISA-like mathematics task with Indonesia natural and cultural heritage as context to assess students mathematical literacy. *Journal on Mathematics Education*, *7*(1), 1-8. https://doi.org/10.22342/jme.7.1.2812.1-8

Prasetyono, H., Abdillah, A., Djuhartono, T., Ramdayana, I. P., & Desnaranti, L. (2021). Improvement of teacher's professional competency in strengthening learning methods to maximize curriculum implementation. *International Journal of Evaluation and Research in Education*, *10*(2), 720-727. https://doi.org/10.11591/ijere.v10i2.21010

Puad, L. M. A. Z., & Ashton, K. (2023). A critical analysis of Indonesia's 2013 national curriculum: Tensions between global and local concerns. *The Curriculum Journal*, *34*(3), 521-535. https://doi.org/10.1002/curj.194

Purnomo, H., Sa'dijah, C., Hidayanto, E., Sisworo, S., Permadi, H., & Anwar, L. (2022). Development of instrument numeracy skills test of minimum competency assessment (MCA) in Indonesia. *International Journal of Instruction*, *15*(3), 635-648. https://doi.org/10.29333/iji.2022.15335a

Purnomo, H., Sa'dijah, C., Permadi, H., Anwar, L., & Cahyowati, E. T. D. (2023). Mathematical creative processing abilities of junior high school students' in numeracy tasks. *AIP Conference Proceedings*, *2569*(1), 040012. https://doi.org/10.1063/5.0113667

Rahman, A., & Dewi, L. (2024). The effectiveness of the Indonesian education curriculum in enhancing middle school students' literacy and numeracy skills. *Educational Administration: Theory and Practice*, *30*(5), 11901-11906.

Rahman, K. A., Hasan, M. K., Namaziandost, E., & Ibna Seraj, P. M. (2021). Implementing a formative assessment model at the secondary schools: attitudes and challenges. *Language Testing in Asia*, *11*(1), 18. https://doi.org/10.1186/s40468-021-00136-3

Rizki, R. A., & Fahkrunisa, L. (2022). Evaluation of implementation of independent curriculum (kurikulum merdeka). *Journal of Curriculum and Pedagogic Studies (JCPS)*, *1*(1), 32-41.

Rohmah, A. N., Sutama, S., Hidayati, Y. M., Fauziati, E., & Rahmawati, L. E. (2022). Planning for cultivation numerical literacy in mathematics learning for minimum competency assessment (AKM) in elementary schools. *Mimbar Sekolah Dasar*, *9*(3), 503-516. https://doi.org/10.53400/mimbar-sd.v9i3.51774

Roza, P., Sulistyaningtyas, T., Munaf, D. R., Jatnika, A. W., & Suryani, Y. (2016). Revitalizing the Indonesian national values to strengthen the nation's character. In *The Asian Conference on the Social Sciences 2016*, (pp. 1-10).

Sa'dijah, C., Purnomo, H., Abdullah, A. H., Permadi, H., Anwar, L., Cahyowati, E. T. D., & Sa'diyah, M. (2023). Students' numeracy skills in solving numeracy tasks: Analysis of students of junior high schools. *AIP Conference Proceedings*, *2569*(1), 040011. https://doi.org/10.1063/5.0113664

Saidek, A. R., Islami, R., & Abdoludin, A. (2016). Character issues: Reality character problems and solutions through education in Indonesia. *Journal of Education and Practice*, *7*(17), 158-165.

Santillan, J. P. (2023). Exploring challenges and factors in students' literacy: Basis for intervention program development. *Journal of Educational and Management Studies*, *13*(2), 14-22. https://doi.org/10.54203/jems.2023.2

Smith, C., & Morgan, C. (2016). Curricular orientations to real-world contexts in mathematics. *The Curriculum Journal*, *27*(1), 24-45. https://doi.org/10.1080/09585176.2016.1139498

Srirahmawati, A., & Hunaifi, A. A. (2022). Realizing Pancasila student profiles in the elementary school with learning media based on local wisdom 'Barongan Masks'. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *8*(2), 375-385. https://doi.org/10.33394/jk.v8i2.4758

Sukmayadi, V., & Yahya, A. (2020). Indonesian education landscape and the 21st century challenges. *Journal of Social Studies Education Research*, *11*(4), 219-234. https://learntechlib.org/p/218538

Supriatna, D., Nadirah, S., Aniati, A., Rahman, A., Aina, M., & Saefudin, A. (2023). Implementation of merdeka belajar curriculum in elementary schools: How is teachers' perception? *International Journal of Education, Vocational and Social Science*, *2*(2), 30-40.

Syahida, H., & Dewi, L. (2023). Identifying 21st-century skills in the "kurikulum merdeka" at the elementary level numeracy aspect: A literature review. In *International Conference on Elementary Education*, (Vol. 5, pp. 308-314).

Taufik, I., & Rindanigsih, I. (2024). Education transformation: The impact of teacher training in implementing the merdeka curriculum in Madrasah Ibtidaiyah. *International Journal Multidisciplinary (IJMI)*, *1*(1), 9-15. https://doi.org/10.61796/ijmi.v1i1.31

Tindell, D. R., & Bohlander, R. W. (2012). The use and abuse of cell phones and text messaging in the classroom: A survey of college students. *College Teaching*, *60*(1), 1-9. https://doi.org/10.1080/87567555.2011.604802

Tsatsaroni, A., & Evans, J. (2014). Adult numeracy and the totally pedagogised society: PIAAC and other international surveys in the context of global educational policy on lifelong learning. *Educational Studies in Mathematics*, *87*(2), 167-186. https://doi.org/10.1007/s10649-013-9470-x

Uğur, N. G., & Koç, T. (2015). Mobile phones as distracting tools in the classroom: College students perspective. *Alphanumeric Journal*, *3*(2), 57-64.

Utami, W. B., Wedi, A., Sulthoni, S., & Aulia, F. (2023). Management of merdeka curriculum towards strengthening the profile of Pancasila students in schools. In *International Conference on Educational Management and Technology (ICEMT 2022)*, (pp. 240-246). https://doi.org/10.2991/978-2-494069-95-4_29

Werang, B. R. (2023). School principal leadership, teachers' commitment and morale in remote elementary schools of Indonesia. *Multidisciplinary Journal of Educational Research*, *13*(3), 325-347. https://doi.org/10.17583/remie.9546

Wijaya, T. T., Hidayat, W., Hermita, N., Alim, J. A., & Talib, C. A. (2024). Exploring contributing factors to PISA 2022 mathematics achievement: Insights from Indonesian teachers. *Infinity Journal*, *13*(1), 139-156. https://doi.org/10.22460/infinity.v13i1.p139-156

Winarno, W., Muchtarom, M., & Fauziyah, H. (2024). Readiness and efforts of civics teachers in developing literacy and numeracy skills. *Journal of Education and Learning (EduLearn)*, *18*(4), 1209-1223. https://doi.org/10.11591/edulearn.v18i4.21425

Yamtinah, S., Utami, B., Masykuri, M., Mulyani, B., Ulfa, M., & Shidiq, A. S. (2022). Secondary school science teacher response to minimum competency assessment: Challenges and opportunities. *Jurnal Penelitian Pendidikan IPA*, *8*(1), 124-131. https://doi.org/10.29303/jppipa.v8i1.1075

Yerizon, Y., Arnellis, A., Suherman, S., Arnawa, I. M., Sa'dijah, C., & Anwar, L. (2024). *The effectiveness of adaptive digital learning material (ADLM) in improving students' numeracy literacy ability*. Preprint. https://ssrn.com/abstract=4751421

Yulianto, H. (2022). Implementation of learning assessment model on the curriculum of Merdeka Belajar. *Technical and Vocational Education International Journal (TAVEIJ)*, *2*(2), 22-34.

Zakso, A., Agung, I., Sofyatiningrum, E., & Capnary, M. C. (2022). Factors affecting character education in the development of the profile of Pancasila students: The case of Indonesia. *Journal of Positive School Psychology*, *6*(2), 2254-2273.

Zidan, M. R., & Qamariah, Z. (2023). A literature study on the implementation of merdeka curriculum. *Jurnal Riset Rumpun Ilmu Bahasa*, *2*(2), 153-167. https://doi.org/10.55606/jurribah.v2i2.1576