Navigating the Digital Wave: Enhancing Literacy and Numeracy in Students around the New Capital City, Nusantara, through Computer-Based National Assessment Impact

Suci Yuniarti[✉], Prita Indriawati, Husnul Khotimah, Kiftian Hady Prasetya, Deden Deden, Ganjar Susilo, and Nurliani Maulida

Balikpapan University, Balikpapan, Indonesia
suci.yuniarti@uniba-bpn.ac.id

Abstract. Students must have Literacy and numeracy skills in the Industrial Era 4.0. Computer-based National Assessment (CBNA), mainly the Minimum Competency Assessment (MCA), measures students' reading and mathematics literacy (numeracy). Reading literacy is understanding, using, evaluating, and reflecting on various written texts to develop individual capacity as Indonesian citizens and global citizens to contribute productively to society. At the same time, numeracy is the ability to think using concepts, procedures, facts, and mathematical tools to solve everyday problems in various contexts relevant to individuals as citizens of Indonesia and the world. This research aims to describe the impact of implementing the CBNA on increasing students' literacy and numeracy in Balikpapan City, one of the supporting cities for the new capital of Indonesia, Nusantara. This qualitative research involved school principals, teachers, and middle and high school students. The data collection techniques used were interviews and documentation. The CBNA results in each educational unit provide information about the competency level of literacy and numeracy skills of schools and students. Schools in Balikpapan are categorized as "above," "achieve," "below," and "far below" minimum competency in literacy and numeracy. In addition, middle and high school students in Balikpapan are categorized as "need a special intervention," "basic," "capable," and "proficient" in literacy and numeracy. It impacts school and teachers' policies regarding increasing literacy and numeracy, especially for schools that still need to achieve minimum competency and for students who still have "basic" and "need special intervention" competency levels.

Keywords: Computer-based National Assessment, Literacy, Numeracy.

1   Introduction

In today's digital age (Industry 4.0), strong reading and math skills (literacy and numeracy) are crucial for student success. Reading empowers students to actively participate in their communities, navigate personal finances, and make informed decisions [1].

Math skills help them understand the world around them and think critically [2]. These skills are evaluated internationally through the Programme for International Student Assessment (PISA).

Unfortunately, Indonesia's scores in PISA, along with other assessments, haven't reached desired levels [3]. Participating in PISA since 2000 allows Indonesia to track educational progress and compare itself to other countries. While Indonesia's ranking improved slightly in 2022 (compared to 2018) [4], students still scored below the average in all three tested subjects (math, reading, science). Research suggests that integrating technology and real-world applications into learning can improve literacy and numeracy [5]. Examples include using the Quizizz app, problem-based learning, and project-based learning approaches [6, 7].

To gain a more comprehensive understanding of educational quality, Indonesia introduced the National Assessment (NA) in 2021, complementing PISA. The NA consists of three parts: the Minimum Competency Assessment (MCA) that measures reading and math skills, a Character Survey, and a Learning Environment Survey. This computer-based assessment (CBNA) replaces the former National Exam (NE). This paper focuses on the MCA and its role in evaluating students' literacy and numeracy skills.

Literacy, specifically reading literacy, involves understanding, using, evaluating, and reflecting on various written texts. This equips students to become productive members of society, both in Indonesia and globally [8]. The MCA framework for reading literacy considers three aspects: content (fictional and informational texts), context (personal, social/cultural, and scientific), and cognitive skills (accessing information, interpreting and integrating it, and evaluating and reflecting on it). A more detailed breakdown of this framework can be found in Table 1.

Table 1. The Framework of Literacy [9]

Content	Context	Cognitive Competency
Fictional text is text that aims to provide readers with the experience of getting entertainment, enjoying stories, and reflecting.	Personal, relating to personal self-interest.	Access and retrieve, namely finding information, searching, accessing, and finding explicit information from discourse.
Informational text aims to provide facts, data, and information in the context of developing insight and scientific knowledge.	Socio-cultural is related to interests between individuals, culture, and societal issues.	Interpret and integrate, namely, understanding explicit and implied information, combining interpretations between text parts to produce inferences.
	Scientific is related to scientific issues, activities, and facts, both those that have been carried out and those that are futuristic.	Evaluate and reflect, namely assessing the credibility, suitability, and trustworthiness of the text and being able to relate the content of the text to other things outside the text.

Secondly, numeracy refers to the ability to apply mathematical concepts, procedures, and tools to solve real-world problems in different situations, both personal and related to being a citizen of Indonesia and the world [8]. The MCA framework for numeracy focuses on four content areas: numbers, algebra, measurement and geometry, and data analysis with uncertainty. Similar to reading literacy, the framework considers three contexts (personal, social/cultural, and scientific) and three cognitive skills (understanding mathematical concepts, applying them to solve problems, and reasoning mathematically). A more detailed explanation of this framework can be found in Table 2.

Table 2. The Framework of Numeracy [9]

Content	Context	Cognitive Competency
Number, including representation, sequence properties, and operations on various types of numbers (whole, integer, fraction, decimal).	Personal, relating to personal self-interest.	Understanding, understanding facts, procedures and mathematical tools.
Algebra includes equations and inequalities, relations and functions (including number patterns), ratios, and proportions.	Socio-cultural is related to interests between individuals, culture, and societal issues.	Applying, being able to apply mathematical concepts in real situations that are routine
Measurement and geometry, including recognizing flat shapes and using volume and surface area in everyday life. Also, assess students' understanding of length measurement, weight, time, volume, debit, and area units using standard units.	Scientific is related to scientific issues, activities, and facts, both those that have been carried out and those that are futuristic.	Reasoning, reasoning with mathematical concepts to solve non-routine problems.
Data and uncertainty, including understanding, interpreting, and presenting data and probability.		

The MCA results are reported in four groups depicting different school attributes and students' competency levels. The order of students' competency levels from the least is "need a special intervention," "basic," "capable," and "proficient." Meanwhile, the order of school attributes from the highest is "above minimum competency," "achieve minimum competency," "below minimum competency," and "far below minimum competency." The explanation of each competency level in literacy and numeracy is shown in Table 3. The explanation of each school attributes in literacy and numeracy is shown in Table 4.

As the new policy and paradigm on education evaluation, it is necessary to search for information about the impacts of the CBNA implementation. This study aims to describe the impact of the CBNA implementation, specifically the MCA, on increasing student literacy and numeracy in Balikpapan City, one of the supporting cities for the new capital of Indonesia, Nusantara.

Table 3. The Competency Levels of Literacy and Numeracy [10]

Competency Levels	Literacy	Numeracy
Need special intervention	Students need help finding and retrieving explicit information in the text or making simple interpretations.	Students only have limited mathematical knowledge. Students demonstrate partial mastery of concepts and limited computational skills.
Basic	Students can find and retrieve explicit information in the text and make simple interpretations.	Students have basic mathematical skills: basic computing in the form of direct equations, basic concepts related to geometry and statistics, as well as solving simple, routine mathematical problems
Capable	Students can interpret the implicit information in the text and conclude by integrating several pieces of information.	Students can apply their mathematical knowledge in more diverse contexts.
Proficient	Students can integrate some information across texts, evaluate the content, quality, and way of writing a text, and be reflective about the content of the text.	Students can reason to solve complex and non-routine problems based on their mathematical concepts.

Table 4. The School Attributes of Literacy and Numeracy [10]

Competency Levels	Literacy	Numeracy
Need special intervention	Students need help finding and retrieving explicit information in the text or making simple interpretations.	Students only have limited mathematical knowledge. Students demonstrate partial mastery of concepts and limited computational skills.
Basic	Students can find and retrieve explicit information in the text and make simple interpretations.	Students have basic mathematical skills: basic computing in the form of direct equations, basic concepts related to geometry and statistics, as well as solving simple, routine mathematical problems
Capable	Students can interpret the implicit information in the text and conclude by integrating several pieces of information.	Students can apply their mathematical knowledge in more diverse contexts.
Proficient	Students can integrate some information across texts, evaluate the content, quality, and way of writing a text, and be reflective about the content of the text.	Students can reason to solve complex and non-routine problems based on their mathematical concepts.

2   Methods

This study employs a qualitative approach, which views social realities as interconnected, ever-changing, and shaped by meaning-making [11]. This method was chosen for its suitability to the research goals. The research took place in middle and high schools across Balikpapan City. The participants were chosen strategically to best answer the research questions [12]. These included school principals, teachers, and students from both middle and high schools. Data collection involved interviews and document analysis. Interviews helped researchers understand the effects of implementing the CBNA and the MCA results. Documents provided information on Balikpapan's MCA results.

Data analysis happened concurrently with and after data collection. The Milles and Huberman model guided this process, which involved three steps: data reduction, data presentation, and drawing conclusions [13]. Data reduction consisted of sorting and analyzing the interview and document data throughout the research. Data presentation involved organizing the reduced data into a clear narrative, allowing for interpretation and ultimately, conclusions based on the analysis.

To ensure the data's credibility, triangulation and peer verification were employed. Triangulation involved comparing data from interviews and documents to identify any inconsistencies. Peer verification involved discussing the research process and findings with colleagues for further validation.

3   Results and Discussion

The documentation of the report of the result of MCA showed that middle and high schools in Balikpapan are categorized as "above," "achieve," "below," and "far below" minimum competency in literacy and numeracy. In addition, middle and high school students in Balikpapan are categorized as "need a special intervention," "basic," "capable," and "proficient" in literacy and numeracy. The result of the MCA can be accessed by the Rapor Pendidikan (Education Report) platform on the website https://raporpendidikan.kemdikbud.go.id/login. The Education Report displays the results of national assessments and surveys involving education units and regions. Education units and local governments can use the Education Report to identify problems, reflect on their roots, and improve the quality of education as a whole [13].

Based on interviews with principals, the school made budgeting adjustments based on the MCA result. Schools that still need minimum competency hold in-house training to improve teachers' competencies using the school budget. The training is intended to strengthen the capacity of teachers as facilitators or primary implementers of numeracy literacy familiarization programs. Literacy and numeracy can be pursued by implementing a positive learning climate and culture in schools, forming literacy teams and communities of practitioners, involving third parties and parents, and including school programs in learning and extracurricular activities [14].

The outcome of interviews with teachers revealed that teachers developed learning strategies according to student achievement to improve literacy and numeracy significantly. Some learning models that can be used to enhance literacy are the RADEC (Read-Answer-Discuss-Explain-Create) learning model [15], edutainment learning method, problem-based learning, Student Facilitator and Explaining, learning model using Wattpad and fairytale, Jolly Phonics, flashcard path to literacy and cooperative script [16]. In addition, some learning models that can be used to improve numeracy are the Means Ends Analysis (MEA) model using the Digital Literacy Card [17], problem-based learning, the STEM approach, and Realistic Mathematics Education (RME) [18].

Teachers also started to habituate students for working on multiple-choice, complex multiple-choice, short essay, essay, and matching questions based on the particular topics they teach. These are the MCA question types, which are similar to PISA questions. School policy set the rule to apply end-of-semester assessment using the MCA question types. Getting used to working on PISA-type questions is done so that students get used to dealing with PISA questions, and their mathematical literacy skills will improve [19]. Furthermore, PISA reading literacy questions are dominated by high-level thinking skills in the form of interpretation, reflection, and evaluation skills [20], so students who are only used to reading as "a way of recording orthographic symbols silently or loudly" will be "overwhelmed" by the complex texts presented by the PISA test [21].

Based on interviews with students, students chosen as participants of the MCA were not determined by the school but by MoEC. In line with teachers, students said they did the MCA question types in the end-of-semester assessment. Students also participated in remedial and enrichment programs based on their learning achievement. Remedial programs can be done using classical tutoring services which effectively improving students' literacy and numeracy skills in learning [22]. In contrast, enrichment programs can be done by utilizing physical environments at school like libraries, reading corners, and numeracy stages [23].

4   Conclusion

The CBNA, particularly the Minimum Competency Assessment (MCA), gathers data on schools' and students' literacy and numeracy skills. This information influences how schools and teachers approach improving these skills, especially in low-performing schools and for students struggling to meet benchmarks. The study highlights the need for further research on how literacy and numeracy skills vary across different subjects and locations.

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