INOVASI
Innovation for Indonesia's School Children
Australia Indonesia Partnership

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN

Australian Government

POLICY BRIEF

BASIC NUMERACY: BUILDING BLOCKS FOR THE FUTURE

INOVASI is an education program partnership between the Governments of Indonesia and Australia. It aims to find and understand ways to improve student learning outcomes - specifically those related to early grade literacy and numeracy at the school and classroom level.

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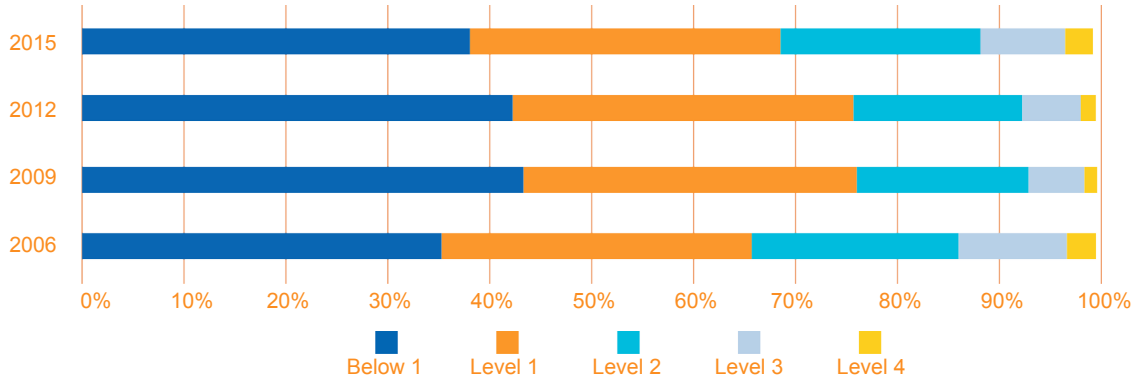
WHY DOES BASIC NUMERACY MATTER IN INDONESIA?

The relationship between a skilled work force and the achievement of basic competencies in literacy and numeracy is an important one, underpinning higher order thinking skills (HOTS) such as critical thinking and problem solving. Simply put, if students have not developed minimum competence in literacy and math, the prospect for a highly skilled and relevant workforce remains slim[1].

When it comes to international test results across Indonesia, it is clear that students are failing to grasp mathematical concepts used in real-world problems[2]. Over the last four PISA assessments, spread across the past decade, Indonesia's performance has remained much the same. Approximately 40 per cent of children age 15 are still below the lowest level of the international standard.[3]

FIGURE1: PISA MATHS - % OF STUDENTS AT EACH LEVEL OF COMPETENCE 2006-2015. (PISA REPORT 2015)



Key skill areas include: an awareness of the relationship between number and quantity, an understanding of number symbols, vocabulary and meaning, the ability to engage in systematic counting, awareness of the comparison between different number magnitudes, a better understanding of number representations and number patterns, and competence with simple mathematical operations.

While numeracy is no less important than literacy for Indonesia, the current climate is less amenable to policy solutions for numeracy issues. This may be because literacy learning outcomes can potentially be improved by providing appropriate reading books, and building a reading culture, without having to revise the national curriculum. This is more difficult for numeracy. As observed from INOVASI's pilots, the way the 2013 curriculum is interpreted in teachers' guides and student workbooks, prioritises children's ability to perform mathematical calculations (sums), often without building understanding of how these apply in the real world[4].

WHAT DO WE KNOW?

INOVASI's 2018 baseline findings from across its four partner provinces showed lower than expected scores on the early grade student numeracy test. The average score for the numeracy *comprehension* test (for those who passed the basic numeracy test) was 45.1 (out of 100), the girls' score (46.1) is slightly higher than the boys whose average score was 44.2. Results were poorer in more remote and regional areas, like East Nusa Tenggara[5] (see figure 2). Scores in areas like counting and comparison were higher than in areas like geometry and fractions.

FIGURE 2: EARLY GRADE STUDENTS NUMERACY COMPREHENSION SCORES (OUT OF 100)

Province	Early Grade Students Numeracy Score	Early Grade Students Numeracy Score by Gender	
		Girls	Boys
NTT	29.6	30.0	29.3
NTB	45.9	46.9	45.0
NORTH KALIMANTAN	40.5	42.2	39.0
EAST JAVA	51.5	53.1	50.0

For all data related to student results, only data on INOVASI partner schools is included. Only those students who passed the basic numeracy test completed the numeracy comprehension test

[1]TASS working paper, 2019

[2]https://www.oecd.org/indonesia/pisa-2015-indonesia.htm

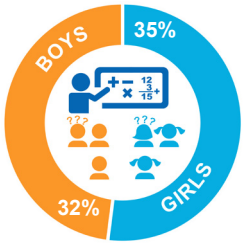
[3]TASS working paper, 2018, using data from OECD (2015)

[4]https://www.inovasi.or.id/en/publication/report-guru-baik-building-teachers-capacity-in-west-nusa-tenggara-indonesia/

[5]https://www.inovasi.or.id/en/publication/infographic-preparing-a-generation-for-the-21st-century-the-case-for-improving-early-grade-literacy-and-numeracy/

A commonly cited issue globally is that teachers and children in primary schools tend to see mathematics as a difficult subject (Abu Bakar, et al., 2010[6]; Ofsted, 1994[7]; Brown, et al., 2008[8]). Our baseline study findings support this: one out of every three students perceive mathematics as their most difficult subject (35 per cent for girls and 32 per cent for boys). Most students named the subject content as the reason[9].

FIGURE 3: PERCENTAGE OF INOVASI PARTNER STUDENTS WHO PERCEIVE MATHS AS THEIR MOST DIFFICULT SUBJECT



Meanwhile, 55 per cent of teachers perceive mathematics as a difficult subject for children to understand. Based on INOVASI's comprehensive numeracy baseline test, on average, the girls' numeracy score was 51, which is only slightly higher than the boys whose average score was 48.

Through our exploratory pre-pilot work, the foundational numeracy pilot and the *Guru BAIK* teacher competency pilots, we have also found that teachers in the mid-primary grades (three and four) struggle to understand and teach concepts relating to fractions and division. This is thought to indicate problems originating in the earlier grades (one and two). Students' performance in our basic numeracy test reveal that they have a lower ability to work on higher level 'reasoning' skills, like fractions and decimals. Test scores in areas of content knowledge, like number identification, were higher[10]. By cognitive domain, in general, students scored lower in areas that required higher order thinking skills (HOTS) like content application.

FIGURE 4: STUDENT TEST SCORES (OUT OF 100) BASED ON CONTENT DOMAINS

Province	Cognitive Domain		Content Domain		
	Knowing	Applying	Numbers	Geometry	Fractions/ decimal
NTT	31.6	7.4	29.7	24.2	30.1
NTB	47.5	17.6	46.9	41.3	28
NORTH KALIMANTAN	40.8	20.5	38.8	39.5	24.1
EAST JAVA	54.6	17.8	52.9	46.7	32.9

We found that too often mathematical concepts are rushed through in the early grades without time spent on embedding the concept. It is important that teachers take time to develop their techniques and for children to explore, practice, take risks, persist, try again and show their mathematical understanding or misunderstanding. This can be best done by talking about the process or showing the process in the classroom, with engaging teaching methods and media.

WHAT ARE THE KEY ISSUES?

Strategic issues in basic numeracy include:

1. The 2013 curriculum and the accompanying teachers' guides prioritise students' ability to perform mathematical processes (sums), often without building understanding of how these apply in the real world and without adequate basic numeracy concepts. This aligns with international experience, which suggests that the mathematics curriculum moves too fast and children in early grades are not given the opportunity to acquire a solid understanding of number or the ability to think mathematically.
2. There is a clear need for a more flexible interpretation of the national curriculum in the early grades when it comes to numeracy. This would provide the opportunity for more comprehensive and concrete learning in numeracy and could take the form of revised teachers' guides or children's workbooks. As observed from INOVASI's pilots, often times the curriculum focuses heavily on calculations and not on 'making meaning' from math concepts.
3. Teachers are not confident in teaching math, and would benefit from strengthened pre-service training. They would also do well to improve how they use formative assessment in the classroom, so as to better track student progress and issues in mathematics, differentiate student learning, and inform lesson planning.

[6]https://doi.org/10.1016/j.sbspro.2010.12.055

[7]Ofsted. 1994. Science and mathematics in schools: a review. London: Her Majesty's Stationary Office.

[8]DOI: 10.1080/14794800801915814

[9]https://www.inovasi.or.id/en/publication/infographic-preparing-a-generation-for-the-21st-century-the-case-for-improving-early-grade-literacy-and-numeracy/

[10]https://www.inovasi.or.id/en/publication/report-guru-baik-building-teachers-capacity-in-west-nusa-tenggara-indonesia/

POLICY IMPLICATIONS & RECOMMENDATIONS

NATIONAL

Recommendations and priorities at the national level include:

1. Puspendik's work on AKSI, including new assessments (the AKSI survey) could be implemented and used to inform national policy decisions. AKSI at school level can then be used by teachers, schools and district government as formative assessment to inform teaching and as a training needs identification for CPD.
2. Review the way K13 is implemented in the classroom (and teacher guidebooks and student texts and workbooks) to allow more time for concrete, fun challenges that build a solid understanding of number in early grades. The curriculum could be slowed down and aligned more effectively with AKSI testing rather than K13. This should be the basis for more abstract math in higher grades.
3. The Ministry of Education and Culture could ensure that mathematics units are appropriately covered in continuing professional development training and resources for primary school teachers. Teachers could receive professional development in subject areas where they are weakest.

DISTRICT

Policy recommendations and priorities at the district level include:

1. Ensure that teachers are equipped with the knowledge and skills to develop new approaches for teaching number in early grades. This approach should be exploratory, fun and engaging, play-based, and should be supported with concrete learning aids.
2. Provide strengthened training for teachers in formative assessment, so that they can use simple strategies to track student progress and determine the different learning needs of early grade children.
3. District education offices need to strengthen the understanding of curriculum leadership in the field of Mathematics (Curriculum leadership in Mathematics) for school principals. In practice, changes that occur in schools only succeed if the principal has effective curriculum leadership. Principals could provide teachers with the time and resources to plan learning, testing new approaches to mathematics in schools.

This Policy Brief was prepared by INOVASI and the Center for Education Policy Research, from the Ministry of Education and Culture's Research and Development agency.

Data includes results from INOVASI's baseline and endline studies in partner provinces West Nusa Tenggara, East Nusa Tenggara, North Kalimantan and East Java.