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Examining Challenges and Opportunities to Improve the Quality of Education in Indonesia

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Majelis Dikdasmen dan PNF PP Muhammadiyah

Research Report: Examining challenges and opportunities to improve the quality of education in Indonesia

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Authors: SMERU Research Team (Asri Yusrina, Risa Wardatun Nihayah, Affandi Ismail, Sylvia Andriyani Kusumandari, Veto Tyas Indrio, Heni Kurniasih) and Dr. Rasidi, Fakry Hamdani, Ph.D, Kaharuddin, Ph.D, and Prof. Siti Nurul Azkiyah as visiting researchers.

Research Advisory Group: Ministry of Primary and Secondary Education (Prof. Dr. Toni Toharuddin, S.Si., M.Sc., Dr. Muhammad Yusro, S.Pd., M.T., M.Pd, Irsyad Zamjani, Ph.D., Lukman Solihin), - previously Ministry of Education, Culture, Research, and Technology (Anindito Aditomo, Ph.D., Fransisca Nur'aini Krisna, Anang Ristanto), Ministry of Religious Affairs (Prof. Dr. Rohmat Mulyana, Drs. Abdul Basith, MM., Ir. Dudi Iswadi), Majelis Dikdasmen dan PNF PP Muhammadiyah (Dr. Ananto Kusuma Seta and Drs. Unang Rahmat), Pusat Studi Pendidikan dan Kebijakan (PSPK) (Stien J. Matakupan), Save the Children (Imelda T. Usnadibrata, Adhimas Widjaja), Foreign, Commonwealth & Development Office (FCDO) UK (Aisha Sabila), Jaringan Pemantau Pendidikan Indonesia (JPPI) (Ubaid Matraji), Article 33 (Santoso), UNICEF (Teresita Felipe, Anissa Elok Budiyani).

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This report presents the findings of a diagnostic study aimed at identifying challenges and opportunities for transforming the quality of education in Indonesia. Elements that enhance basic skills (literacy and numeracy) and 21st century skills (creative thinking and critical reasoning) are focused upon, using the lens of gender equality, disability and social inclusion (GEDSI). The study utilizes existing national student assessment data: the National Assessment (*Asesmen Nasional* - AN) from MoPSE, the Madrasah Competency Assessment (*Asesmen Kompetensi Madrasah Indonesia* - AKMI) from MoRA, and other data sources to help provide an overview of student learning outcomes.

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Abstract

This study examines factors influencing the quality of education in Indonesia, with a focus on students' performance in national assessments (*Asesmen Nasional* – AN and *Asesmen Kompetensi Madrasah Indonesia* – AKMI). Employing a mixed methods approach, the research combines quantitative analysis of 2023 AN and AKMI data with qualitative insights from case studies conducted in Magelang district (Central Java) and Maros district (South Sulawesi). The study also explores disparities in learning outcomes between public and private schools and madrasahs, as well as gender-based differences, identifying key contributors to these gaps.

An analysis of AN data reveals that the implementation of a student-centred national curriculum, diverse representation of teachers, parental engagement, and a positive school environment are key factors influencing learning achievement. The availability of libraries and internet access in schools and madrasahs has varying impacts on student learning outcomes, depending on the educational context, showing positive correlations in some settings, while appearing less significant in others.

Diversity in teacher characteristics has a high impact on learning achievement, highlighting the importance of managing the diverse needs and experience of teachers in Indonesia. A balanced approach to teacher development and support is crucial through sustained collaborative learning and knowledge sharing, which can be promoted through the school or madrasah learning community approach.

Innovative teaching practices negatively correlated with literacy and numeracy scores but positively correlated with students' creative thinking and critical reasoning. This contrast may stem from limited classroom implementation and tech-focused interpretation hindering its effectiveness in strengthening foundational skills.

A safe and inclusive school and madrasah climate is positively associated with student academic performance across all educational levels. Characteristics of such a school environment, which includes effective classroom management, positive discipline, absence of bullying, a positive attitude toward disabilities, and disability services, all showed positive correlations with students' achievement across all educational levels. Qualitative findings also highlighted the importance of effective school leadership.

Achievement gaps in literacy, numeracy, and 21st century skills between public and private schools and madrasahs stem from differences in teacher profiles, school characteristics and transformation efforts. Addressing these key disparities can foster more equitable learning outcomes and narrow achievement gaps between public and private across educational settings. Overall, the findings underscore the need for context-specific interventions targeting various factors to improve the quality of education in Indonesia.

Keywords: national assessments, literacy, numeracy, 21st century skills, learning gap.

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Acronyms and abbreviations

AKM	*Asesmen Kompetensi Minimum*	Minimum Competency Assessment
AKMI	*Asesmen Kompetensi Madrasah Indonesia*	Madrasah Competency Assessment
AN	*Asesmen Nasional*	National Assessment
BBPMP	*Balai Besar Penjaminan Mutu Pendidikan*	Education Quality Assurance Centre
CRC	*Konvensi Pemenuhan Hak Anak*	Convention on the Rights of the Child
Dapodik	*Data Pokok Pendidikan*	Basic Education Data
DMS	*Sistem Pemantauan Dasar*	Dashboard Monitoring System
EMIS		Education Management Information System
FGD		Focus Group Discussion
GEDSI		Gender Equality, Disability and Social Inclusion
GPE	*Kemitraan Global untuk Pendidikan*	Global Partnership in Education
GTK	*Guru dan Tenaga Kependidikan*	Teacher and Education Personnel
IASP	*Indeks Akses Satuan Pendidikan*	School Access Index
KIP	*Kartu Indonesia Pintar*	Indonesian Smart Card
Kombel	*Komunitas Belajar*	Learning Communities
KurMer	*Kurikulum Merdeka*	Emancipated Learning Curriculum
MPI/LEG	*Mitra Pendidikan Indonesia*	Local Education Group
MI	*Madrasah Ibtidaiyah*	Primary schools under Ministry of Religious Affairs
MoECRT	*Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi*	Ministry of Education, Culture, Research, and Technology
MoPSE	*Kementerian Pendidikan Dasar dan Menengah*	Ministry of Primary and Secondary Education
MoRA	*Kementerian Agama*	Ministry of Religious Affairs
MTs	*Madrasah Tsanawiyah*	Junior secondary schools under Ministry of Religious Affairs
NU	*Nahdlatul Ulama*	
P3K	*Pegawai pemerintah dengan perjanjian kerja*	Contractual teachers
Permendik-budristek	*Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi*	Regulation of the Minister of Education, Culture, Research, and Technology
PINTAR	*Pusat Informasi Pelatihan dan Pembelajaran*	Center for Training and Learning Information
PISA		Programme for International Student Assessment

PMM	Platform Merdeka Mengajar	
RQ		Research questions
SD	Sekolah Dasar	Primary schools under Ministry of Education, Culture, Research, and Technology
SDGs		Sustainable Development Goals
SES		Socioeconomic status
SLB	Sekolah Luar Biasa	Special Needs Schools
SMP	Sekolah Menengah Pertama	Junior secondary schools under Ministry of Education, Culture, Research, and Technology
Sulingjar	Survei Lingkungan Belajar	Learning Environment Survey

1 Introduction

Indonesia's education landscape is characterized by a parallel system that reflects the nation's commitment to accommodating its diverse cultural and religious population. The dual administrative structure is led by the Ministry of Primary and Secondary Education (MoPSE), formerly the Ministry of Education, Culture, Research, and Technology (MoECRT)[1], and the Ministry of Religious Affairs (MoRA), each overseeing distinct educational streams. This system enables the country to cater to a broad spectrum of educational needs, blending general education with religious teachings.

MoPSE administers general education, focusing on delivering a national curriculum that covers academic subjects like literacy, numeracy, science, social studies, and character education. The prevalent model of Islamic education in Indonesia, managed by MoRA, integrates Islamic studies with academic subjects from the national curriculum in institutions such as madrasahs and pesantren (Islamic boarding schools). This approach balances religious values with broader educational development, although some institutions may prioritize religious teaching alone.

Since 2021, Indonesia has embarked on a national education reform aimed at transforming its educational system to enhance quality and maintain relevance within the global educational context. These transformation initiatives included introducing student-centred emancipated learning curricula, implementing competency-based student learning assessments, and integrating digital learning systems, among others. These initiatives aim to improve education outcomes and ensure that students from both the MoPSE and MoRA systems are adequately prepared to address the challenges of the 21st century. A key component of this initiative is the *Asesmen Nasional* (AN), a national assessment launched in 2021. This assessment replaces the previously high stakes national exams, returning greater autonomy to teachers in instruction and student evaluation (Aditomo, 2024). The AN assesses not only student proficiency in literacy and numeracy, and key attributes aligned with character education, but also key aspects of effective school transformation, such as teaching practices and school environment.

1 Subsequent to the completion of this research, the Ministry of Education, Culture, Research, and Technology (MoECRT) was reorganized. Its responsibilities are now divided across the Ministry of Primary and Secondary Education (MoPSE), the Ministry of Higher Education, Science, and Technology (MoHEST), and the Ministry of Culture (MoC).

While madrasahs generally align with national educational policies, MoRA retains flexibility in adapting certain aspects, such as assessment methods, to better suit the needs of Islamic schools. A prime example is the Madrasah Competency Assessment (*Asesmen Kompetensi Madrasah Indonesia*-AKMI), which surveys a sample of madrasahs and assesses all students in grades 5, 8, and 10 within those selected madrasahs. This contrasts with the AN, a national assessment evaluating a random sample of students in grades 5, 8, and 10 across all schools and madrasahs. While the AN provides a broad overview of educational outcomes, AKMI specifically targets the competencies of students within Islamic educational institutions. This dual assessment approach provides valuable insights for educational improvement, ensuring that the unique needs of madrasah students are respected and aligned with national educational goals.

Participating in international assessments like the Programme for International Student Assessment (PISA) offers valuable insights into Indonesian students' performance on the global stage. However, national assessments, such as AN and AKMI, provide a more localized understanding of specific literacy, numeracy, and 21st century skills (creative thinking and critical reasoning) challenges within the education system.

Indonesia's education system showcases a commitment to diversity through those two national assessments. However, a 2020 World Bank report emphasized that, despite the 2003 Education Law's objective of integrating all educational institutions under MoPSE and MoRA into a coherent national system, significant disparities persist, particularly between public and private schools and madrasahs. Ongoing reforms and localized assessments are paving the way for ensuring that all students, regardless of the type of education institution they attend, have access to equitable learning opportunities and resources.

Data from the national assessments, AN and AKMI, offer valuable insights for improving Indonesian education quality. This research focuses specifically on primary and junior secondary school/madrasah data from these assessments to inform policy and practice. While future policy directions may change over time, our analyses of existing national assessments allow policymakers and education stakeholders to better understand factors linked to enhanced learning outcomes and to implement strategies to narrow achievement gaps. Ongoing reforms and localized assessments pave the way for a more inclusive framework that benefits all students nationwide.

By examining factors associated with student performance, this study provides insights for policymakers and stakeholders on effective strategies and interventions to enhance education quality and equity. Understanding these factors assists with targeted resource allocation toward practices that yield positive results, helping to address disparities in education access and learning achievement.

The research was conducted under the auspices of the *Mitra Pendidikan Indonesia* (MPI)/ Local Education Group (LEG), co-chaired by MoPSE and MoRA, and was implemented with financing from the Global Partnership for Education (GPE), under the management of UNICEF Indonesia, as Grant Agent for the GPE System Capacity Grant Part 1. A research advisory group was formed from members of the MPI/LEG to provide technical advice to the research team during the course of the research. SMERU undertook this study in collaboration with visiting researchers from Muhammadiyah and Nahdlatul Ulama (NU), two key members of the MPI/LEG, and was supported by education agencies, schools, and madrasahs in Maros district, South Sulawesi province, and Magelang district in Central Java province.

1.1 Research objectives

The aim of this study is to examine challenges and opportunities to improve the quality of education in Indonesian primary and junior secondary schools/ madrasahs. Specifically, this research aims to answer the following questions:

1. What factors are associated with the learning achievement of students in literacy, numeracy, and 21st century skills in Indonesian primary and junior secondary schools/madrasahs?
2. What factors affect the gaps in literacy, numeracy, and 21st century skills achievement between public and private schools/madrasahs, and between boys and girls, in Indonesian primary and junior secondary schools/ madrasahs?
3. How do these factors shape learning practices in the classrooms and settings of Indonesian

junior secondary schools/madrasahs?

1.2 Research data

1.2.1 *Asesmen Nasional* (AN)

Since 2021, the *Asesmen Nasional* (AN) has marked transformation in education systems in Indonesia As opposed to assessing the academic performance of individual students, AN maps and assesses the educational system in terms of inputs, processes, and outcomes. The AN includes the Minimum Competency Assessment (*Asesmen Kompetensi Minimum*-AKM), the Character Survey (*Survei Karakter*), and the Learning Environment Survey (*Survei Lingkungan Belajar-Sulingjar*). The AKM assesses the reading and numeracy skills of a random sample of Indonesian students in grades 5, 8, and 10 across all schools and madrasahs. The Character Survey assesses key student traits associated with character education. The Sulingjar collects data on school climate, teaching practices, and instructional leadership from all teachers and principals at all schools and madrasahs. The results of the AN are made available to education stakeholders at school and subnational government levels on a digital education scorecard platform called *Rapor Pendidikan* (Education Report) (Aditomo, 2024). Access is tiered: principals and teachers can access detailed results for their individual schools/msdrasahs to inform improvements in teaching and learning, while subnational governments (provincial and district level) can analyse the strengths and weaknesses of schools within their jurisdictions. While some summary data is publicly available, the identity of individual schools or students is protected to maintain privacy. This tiered access ensures that the data is used effectively for school improvement while safeguarding sensitive information.

In this study, a sample of 2023 AN data was used, which accounts for almost 30 per cent of all Indonesian primary and junior secondary schools and madrasahs (refer Table 1 below). The data consists of public and private schools managed by MoPSE and MoRA. Hereafter, schools under MoPSE are referred to as primary school (*Sekolah Dasar* - SD) and junior high school (*Sekolah Menengah Pertama* - SMP), while schools managed by MoRA are referred to as Islamic primary school (*Madrasah Ibtidaiyah* - MI) and Islamic junior high school (*Madrasah Tsanawiyah* - MTs). Note that school-level data was used for analysis.

This study examines literacy, numeracy, and 21st century skills, using scores for critical reasoning and creative thinking from the AN dataset. While the AN incorporates PISA-like items, it is important to note that PISA itself does not directly measure '21st century skills' as a distinct construct. However, PISA's emphasis on underlying cognitive processes—such as critical thinking and problem-solving—within its reading, mathematics, and science assessments strongly aligns with the skills needed for 21st century success (OECD, 2023). Understanding the factors influencing these skills in the AN data is crucial for curriculum improvement and preparing students for future challenges, as critical reasoning and creative thinking are essential for effective decision-making, lifelong learning, and adaptability in a dynamic workforce.

The AN dataset itself comprises approximately 50 school-level variables, organized into sections on educator competency and performance (Section C - *Kompetensi dan Kinerja GTK*), teaching quality and related activities in learning (Section D - *Mutu dan Relevansi Pembelajaran*), and school management (Section E -*Pengelolaan Sekolah yang Partisipatif, Transparan, dan Akuntabel*).

While family characteristics are associated with individual student outcomes, their aggregate effect at the school level is often less pronounced. Therefore, this analysis used two proxy variables to represent parental characteristics and student backgrounds, given the limitations of school-level data in providing detailed individual-level information. The two variables utilized in the AN data are parental participation and students' socioeconomic status (SES). Parental participation is measured as a composite score reflecting the involvement of parents in planning, developing, and implementing school activities (E.1.2 provided in section E). Information on students' socioeconomic status is represented by multiple available variables under the school/madrasah socioeconomic index in the AN dataset, (*Indeks Sosial Ekonomi Satuan Pendidikan* - ISESP) (Zamjani et al., 2023).[2]

2 The school/madrasah's socioeconomic index (Indeks Sosial Ekonomi Satuan Pendidikan – ISESP) is as a weighted score that combines the students' socioeconomic index (Indeks Sosial Ekonomi Murid – ISEM) and the Index of School Access (Indeks Akses Satuan Pendidikan – IASP). The ISEM comprises variables such as parents' education and occupation, home learning facilities, the number of books at home, and the number of non-educational household possessions. The IASP comprises mode of transportation index, remoteness index, electricity access index, communication access index, and regional accessibility index.

Table 1. The 2023 *Asesmen Nasional* (AN) Sample: Participation Rates by School/Madrasah Type and Level

Level	Ministry	Type of	School/ Madrasah status[a]	Number of Schools/Madrasahs Participating in the 2023 AN (Meeting Minimum Student Participation Requirements)		
				2023		
				Total[b]	Sample[c]	Percent[d]
Primary madrasahs	MoRA	MI	Public (N)	1,244	368	29.58
Primary madrasahs	MoRA	MI	Private (S)	7,956	2,318	29.14
Primary madrasahs	MoRA	MI	N+S	**9,200**	**2,686**	**29.20**
Primary schools	MoPSE	SD	Public (N)	50,024	14,931	29.85
Primary schools	MoPSE	SD	Private (S)	8,343	2,374	28.45
Primary schools	MoPSE	SD	N+S	**58,367**	**17,305**	**29.65**
Junior secondary madrasahs	MoRA	MTs	Public (N)	1,52	444	29.19
Junior secondary madrasahs	MoRA	MTs	Private (S)	15,249	4,051	26.57
Junior secondary madrasahs	MoRA	MTs	N+S	**16,770**	**4,495**	**26.80**
Junior secondary schools	MoPSE	SMP	Public (N)	23,405	6,837	29.21
Junior secondary schools	MoPSE	SMP	Private (S)	17,392	4,839	27.82
Junior secondary schools	MoPSE	SMP	N+S	**40,797**	**11,676**	**28.62**

Notes:
a Private school/madrasah is denoted as Swasta (S). Public school/madrasah is denoted as Negeri (N).
b Number of school/madrasah that participated in AN 2023 based on the category (i.e., education level, ministry, type of education unit, and school status).
c Number of sample school/madrasah.
d Percentage of sample school/madrasah over total school/madrasah that participated in AN 2023.

The sample of AN data used in this study did not cover information on school location (urban/rural) and did not allow for gender-disaggregated analysis of student outcomes since the data is at the school level. In addition to the AN data, information from Indonesian education databases were used, including the Basic Education Data (*Data Pokok Pendidikan -Dapodik*) for schools managed by MoPSE, and the Education Management Information System (EMIS) for madrasahs managed by MoRA. These datasets provide variables related to school/madrasah characteristics, including whether a school/madrasah is public or private, its accreditation status, the curriculum adopted, the gender of the principal, access to the internet, and the availability of libraries. Schools/madrasahs may implement either the 2013 Curriculum or the Merdeka Curriculum; however, if a school/madrasah implements both, we classified the school/madrasah as implementing the Merdeka Curriculum. This variable will henceforth be referred to as the implementation of the national curriculum.

The research also utilizes school-level data on average teacher characteristics generated from Dapodik and EMIS. The variables include the ratio of female teachers to the total number of teachers at the school, the ratio of teachers with bachelor's degrees, the ratio of teachers aged 40 years and above, and the ratio of certified teachers. Additionally, teacher training-related data from the AN, provided in section C consists of two variables: the percentage of teachers who enhance their competencies and skills through training via the *Platform Merdeka Mengajar* (PMM) (C.3.1) and via other training modalities (C.3.2). PMM is a digital learning platform launched by MoPSE[3], aimed at enhancing teaching and learning practices in schools and madrasahs.

3 PMM was launched in 2022 under MoPSE, currently it is integrated to https://rumah.pendidikan.go.id/ and known as Ruang GTK under MoPSE.

Several variables derived from the Sulingjar instrument, as presented in Sections D of the AN dataset, are categorized as elements of school transformation (Aditomo, 2024). This study focuses on a subset of variables that was identified through a combination of quantitative methodology and theoretical relevance to the study's objectives. Key variables of interest include: scores on classroom management and positive discipline (D.1.1 - average score for classroom atmosphere, orderliness, and positive discipline), innovative teaching practices (D.2.3 – composite scores on the use of new methods, materials, and approaches by teachers to improve instructional quality, as reported by principals and teachers, encompassing the full cycle of planning, delivery, and evaluation), educators' vision and mission for learning (D.3.1 – composite scores on delivery and implementation of the educational unit's vision and mission focused on improving learning), the absence of bullying (D.4.4 - proportion of students reporting feel safe from bullying by teachers or fellow students in the school environment), the absence of physical discipline (D.4.6 - proportion of students reporting no experience of physical punishment at school/madrasah), gender equality behaviours (D.6.2 - average score on gender-equitable behaviour within the school community), disability services (D.10.1 - average score on school services that reflect awareness and attitudes toward students with disabilities), and affectionate attitudes toward disabilities (D.10.3 - average score reflecting teachers' attitudes toward disabilities, based on affective, cognitive (understanding), and behavioural (actions) dimensions).

1.2.2 *Asesmen Kompetensi Madrasah Indonesia* (AKMI)

AKMI is an assessment programme designed to evaluate the competencies of students in madrasahs in Indonesia. AKMI covers four literacy domains, namely (1) Reading Literacy, (2) Numeracy Literacy, (3) Science Literacy, and (4) Socio-Cultural Literacy. These four domains reflect the unique mandate of MoRA and madrasahs. AKMI is designed to capture these comprehensive areas of competencies including characters, tolerance, and attitudes of madrasah students. For example, the AKMI framework defines Socio-Cultural Literacy as a key instrument for measuring religious moderation, national commitment, inter-ethnic and inter-religious tolerance, as well as the ability to be inclusive toward differences (Ministry of Religious Affairs of the Republic of Indonesia, 2023a, p. 2). This domain is specifically designed to support the strengthening of the Islamic character dimension of madrasah students to encourage the willingness to take a middle position, act fairly, and not be extreme in practicing religion. There is no equivalent in AN.

While AKMI covers a broad range of literacies beyond literacy, numeracy, and 21st century skills, for the purpose of this report, analysis is centered around 2 (two) out of the 4 (four) domains.

Further research may be needed to analyze AKMI results across all domains of competency.

This report uses the 2023 AKMI data for MI and MTs levels (grades 5, 8, and 10). However, MTs data was collected as part of a national trial, therefore it was not collected with a sampling probability that represents the national population.

The obtained AKMI data includes variables related to the socio-economic status of students, including the educational and income levels of both parents. The father's income is categorized, with the lowest being '1', representing an income of less than Rp500,000 per month and the highest being '6', indicating an income of more than Rp5,000,000 per month. Acknowledging the significant impact of family characteristics on children's education attainment, analysis was conducted at the student level to complement the school-level data from the AN for madrasahs. To enhance this analysis, non-missing variables in the AKMI data related to school characteristics were utilised, including the school's geographic location (e.g., lowland, mountainous region, or coastal areas). Additionally, several school facilities were considered, such as libraries and laboratories, to ensure a more comprehensive understanding of the factors affecting education outcomes.

Table 2. Number of students in the 2023 AKMI with complete and incomplete data, by madrasah level

Level	School Status	Number of students in sampled madrasah		
		Non-missing variables[a]	Incomplete variables[b]	Total
MI	Public (N)	2,886	N/A	
	Private (S)	59,358	2,318	29.14
	N+S	62,244	280,743	342,987
MTs	Public (N)	486	N/A	
	Private (S)	10,469	N/A	
	N+S	10,955	48,383	59,338

Notes:
a non-missing variables' indicates that each student's data record includes complete information on school characteristics, which includes the school's facilities and geographic location.
b Incomplete variables' indicates that each student's record is missing information on school characteristics.

1.3 Research framework

This study employed a mixed methods approach to address three research questions. The quantitative analysis, using data from AN and AKMI, investigated factors associated with student achievement in literacy, numeracy, and 21st century skills, including factors associated with achievement gaps between public and private schools/madrasahs, and between boys and girls (Research Questions 1 and 2). The qualitative component explored the experiences of school stakeholders (principals, teachers, and students) to understand how these factors shape learning practices in junior secondary school/madrasah classrooms (Research Question 3).

1.3.1 Quantitative framework

Separate quantitative analyses were conducted to address Research Questions 1 and 2. The first examined factors influencing literacy, numeracy, and 21st century skills in Indonesian primary and secondary schools and madrasahs using two different datasets at school/madrasah-level (AN 2023) and student-level (AKMI 2023). The second investigated factors affecting achievement gaps in these skills between public and private schools/madrasahs (school/madrasah-level AN 2023 data), and between boys and girls (student-level AKMI 2023 data).

a. Quantitative analytical framework for research question 1

To address the first research question concerning factors associated with student achievement, a multiple regression model (see Appendix A) was employed. Figure 1 presents the analytical framework for Research Question 1, using school/madrasah-level data from the AN 2023. The framework details the dependent variables (literacy, numeracy, creative thinking, and critical reasoning scores) and independent variables, categorized into school/madrasah characteristics, teacher characteristics, and elements of school transformation.

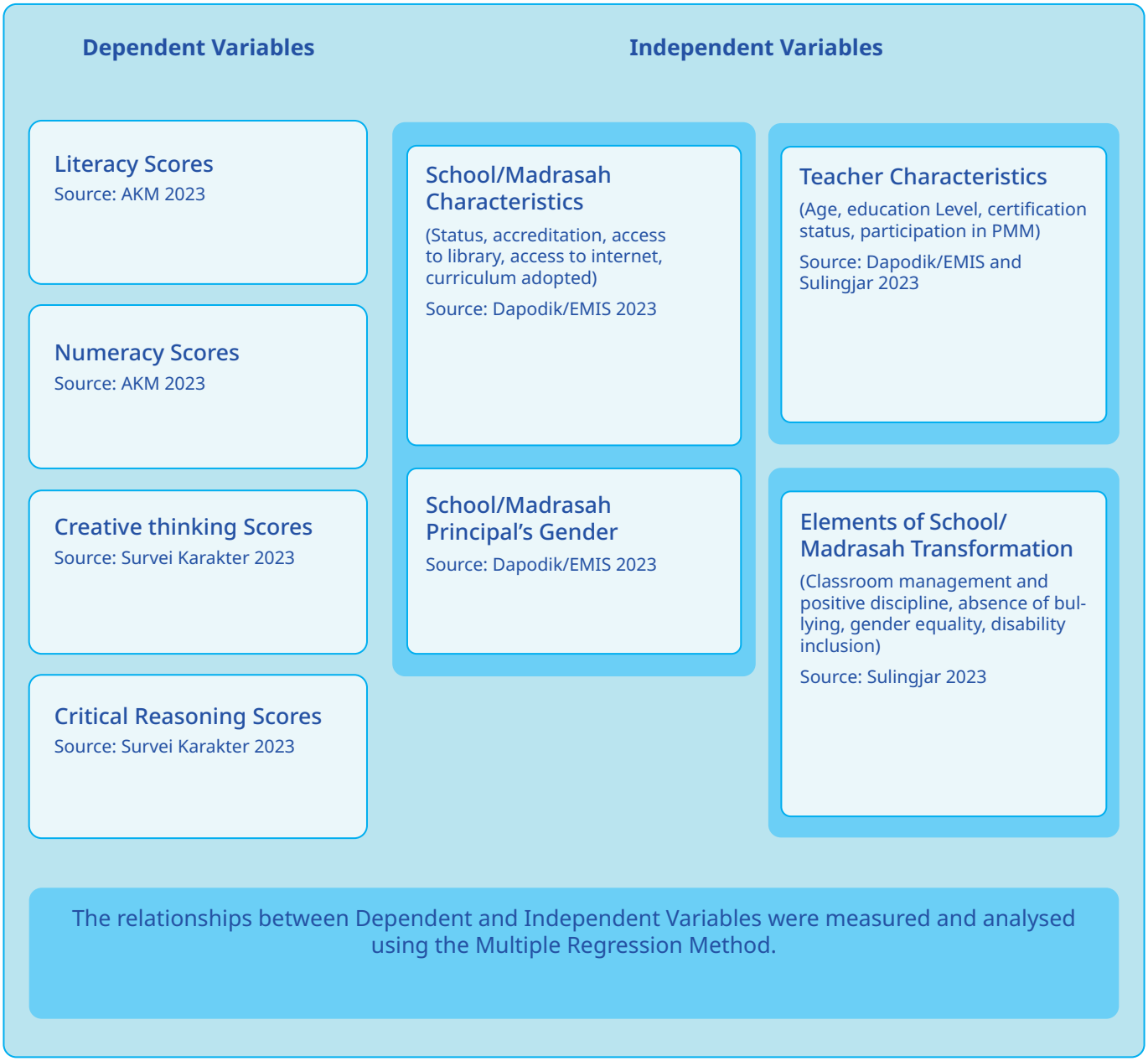
Data on school/madrasah characteristics and teacher characteristics were supplemented by Dapodik and EMIS data, as these are not yet standard components of the AN dataset. Importantly, AN data does not allow analysis of gender differences in student learning outcomes at the school/madrasah level; however, principal gender is included as one of the independent variables.

Separate regression models were estimated for primary schools, primary madrasahs, junior secondary schools, and junior secondary madrasahs. A key difference between the school and madrasah regression models is the inclusion of two teacher training variables: participation in the *Platform Merdeka Mengajar* (PMM) and participation in other training programmes. These variables were unavailable for the madrasah sample.

To ensure model parsimony and interpretability, particularly given the numerous independent variables available in the AN data, our regression models include variables selected using the Lasso method (Tibshirani, 1996) (see Appendix A),

Figure 1. Analytical framework for research question 1 (AN 2023 school/madrasah-level data)

Question 1: ***What factors are associated with the learning achievement of students in literacy, numeracy, and 21st century skills in Indonesian primary and junior secondary schools/madrasahs?***

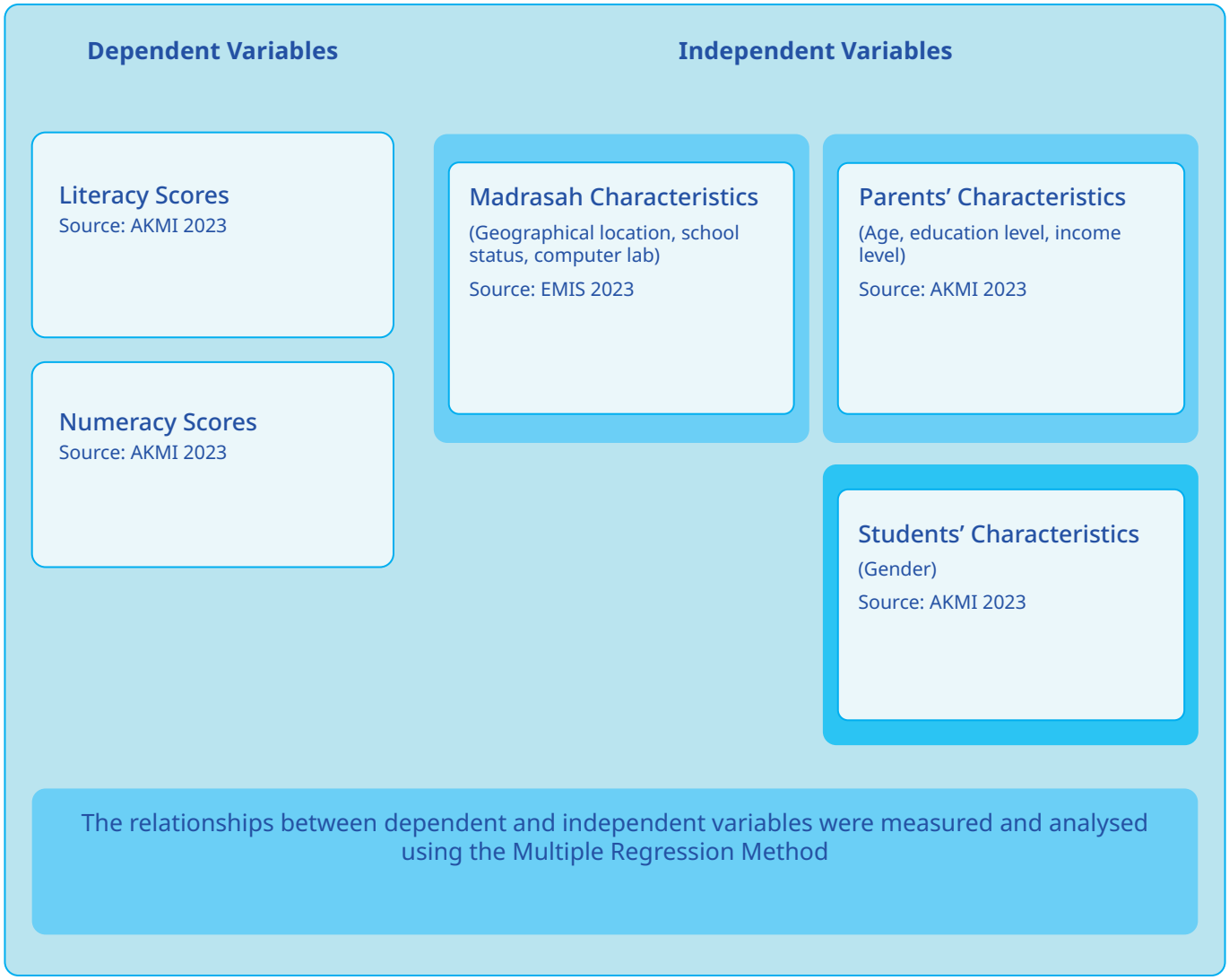


supplemented by theoretically relevant variables. Additionally, since the variables available in AN data are presented in percentage or composite scores from scale 0-100, we standardized the variables to increase interpretability of the relative strength of variables.

Figure 2 depicts the analytical framework used to examine factors influencing literacy and numeracy in Indonesian primary and junior secondary madrasahs, using 2023 AKMI data. Due to limited madrasah-level data in the AKMI dataset, the analysis focuses on student-level variables to identify the association between parental characteristics (age, education level, and income) and student learning outcomes (literacy and numeracy scores). This analysis builds upon Afkar et al.'s (2020) findings highlighting the link between low parental education, a lack of parental involvement, and poor student outcomes. The AKMI data analysis complements the AN analysis by providing a student-level perspective on the factors affecting learning in madrasahs.

Figure 2. Analytical framework for research question 1 (AKMI 2023 student-level data)

Question 1: ***What factors are associated with the learning achievement of students in literacy and numeracy in Indonesian primary and junior secondary madrasahs?***



b. Quantitative analytical framework for research question 2

Previous sections described the use of multiple regression models to analyse the relationship between dependent and independent variables within each education level and type (i.e., primary schools, primary madrasahs, junior secondary schools, and junior secondary madrasahs). However, while informative about correlations, regression does not identify the specific drivers of achievement gaps between public and private schools/madrasahs (institutional disparities) or between girls and boys (gender disparities).

In contrast, the Oaxaca-Blinder decomposition method pinpoints the association of each measured variable to the score gap (the 'explained' component). This method addressed the second research question by identifying factors that contribute to institutional (i.e., public vs. private schools/madrasahs) and gender achievement gaps.

This study focused on identifying these key factors, without prescribing which school type (public or private) or gender should necessarily address them. Furthermore, the decomposition provides insights into unobserved factors associated with achievement gap (the 'unexplained' component), highlighting areas where further research may be needed.

Understanding these factors is crucial for developing targeted policies. For example, if the analysis

identifies internet access as a significant contributor to the achievement gap, then addressing the score gap would necessitate a programme focused on ensuring internet availability and promoting its effective integration into the learning process.

Figure 3 details the analytical framework, outlining dependent variables (literacy, numeracy, creative thinking, and critical reasoning scores) and independent variables categorized into school characteristics, teacher characteristics, and elements of school transformation. The decomposition method was used to analyse how much of the achievement gap between public and private schools/madrasahs is explained by these independent variables, and how much remains unexplained. With school/madrasah-level data from AN 2023, separate decomposition models were made for primary schools, primary madrasahs, junior secondary schools, and junior secondary madrasahs.

Figure 4 illustrates a research framework analysing literacy and numeracy gaps between boys and girls in Indonesian primary and junior secondary madrasahs. Dependent variables are literacy and numeracy scores, while independent variables include school and parental characteristics. The decomposition method assesses the extent to which gender disparities are explained by these factors.

1.3.2 Qualitative framework

This qualitative study explored how factors shape learning practices in Indonesian junior secondary schools/madrasahs by examining the experiences

Figure 3. Analytical framework for research question 2 (AN 2023 school-level data)

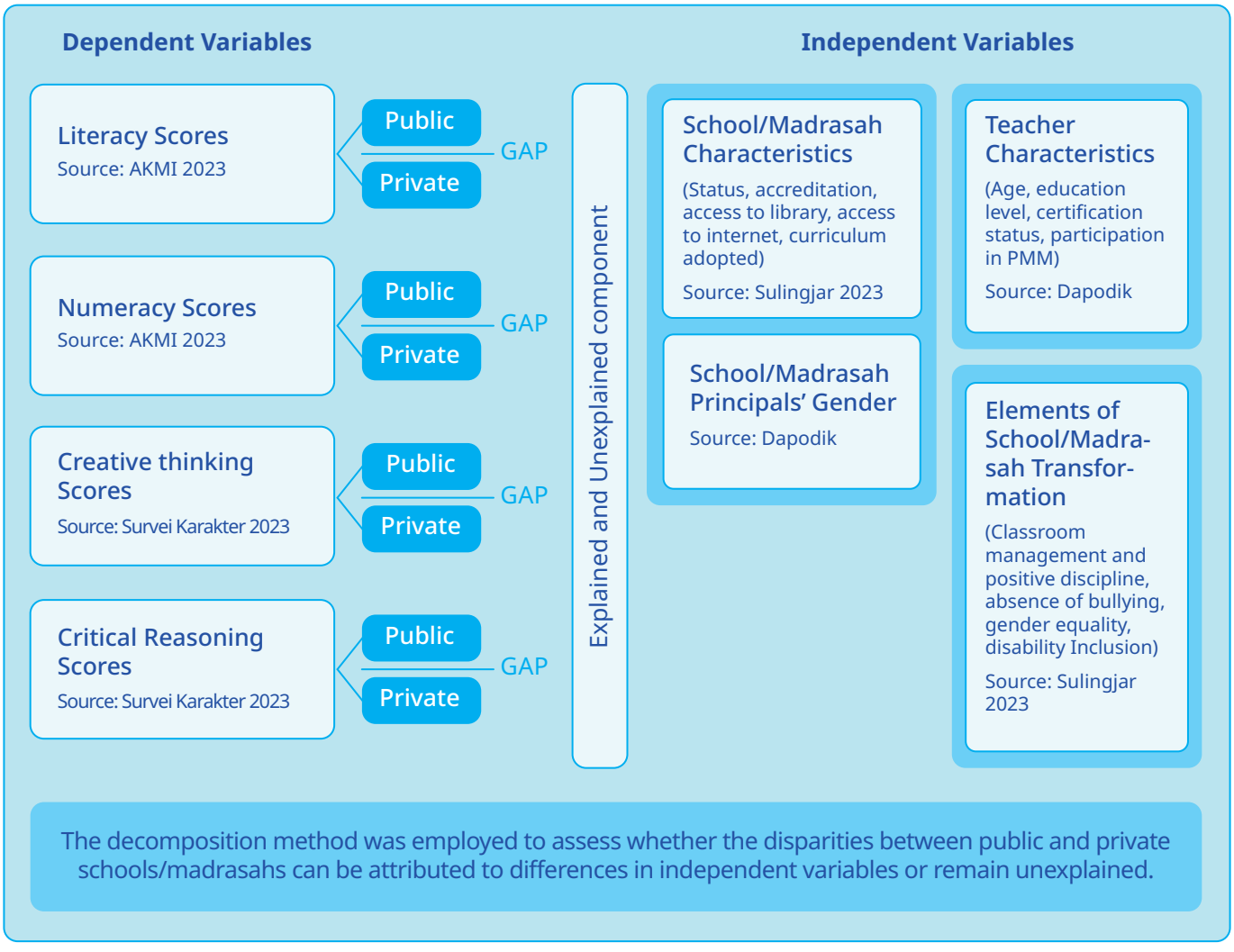
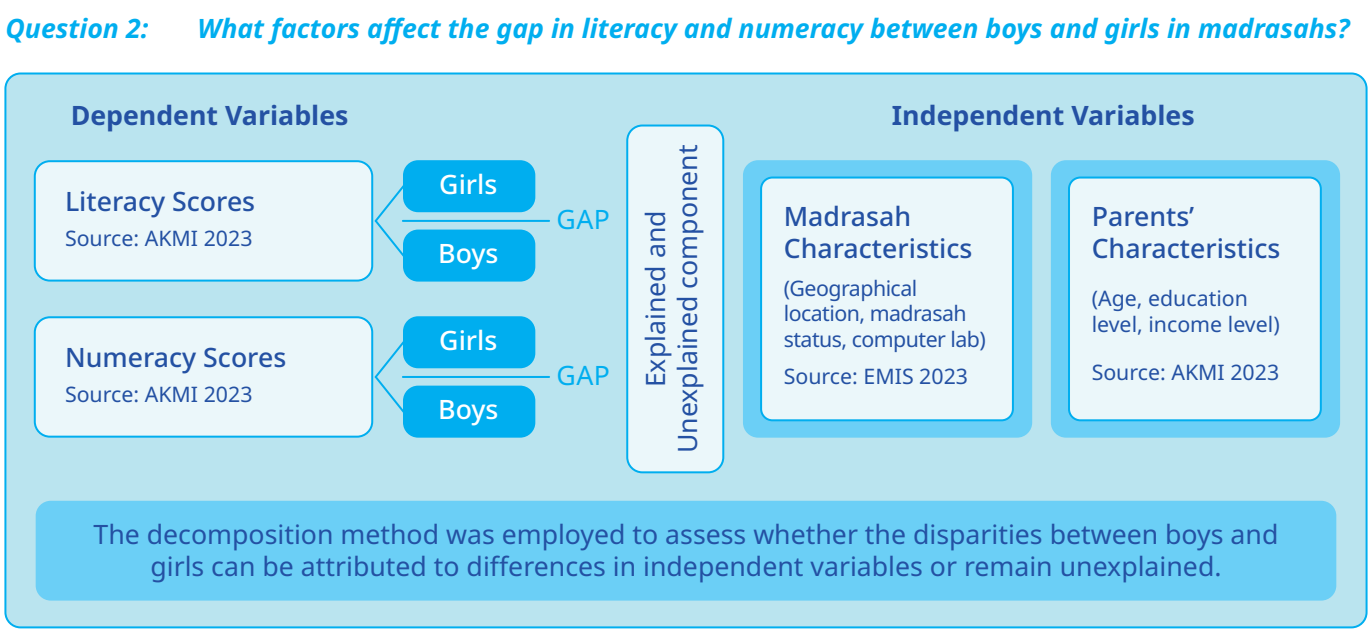


Figure 4. Analytical framework for research question 2 (AKMI 2023 student-level data)



of principals, teachers, and students (Research Question 3). Data was collected in the districts of Magelang (Central Java) and Maros (South Sulawesi). Purposive sampling was implemented to include both rural and urban schools, and to ensure the representation of regular junior secondary schools (SMP) and madrasahs (MTs). To achieve balanced representation, the researchers worked with local education agencies and MoRA office to identify suitable schools and madrasah in each district.

This qualitative study focused on SMP and MTs for two key reasons. Firstly, their smaller number compared to primary schools (SD/MI) facilitated in-depth analysis of distinct learning practices shaped by school/madrasah type (public/private, rural/urban, secular/religious). Secondly, given their presumed capacity for articulate reflection, SMP/MTs students were selected to provide richer insights into the factors influencing classroom instruction.

In-depth interviews were conducted with school and madrasah principals, teachers (grouped by age cohort: under 40 and 40+), and local education officials (MoRA, *Dinas Pendidikan Kabupaten*, BBPMP). Additionally, interviews with school committee representatives explored parental involvement. These data were triangulated with focus group discussions (FGDs) conducted with eighth-grade students and principals in each district. Subsequent thematic analysis intended to identify key themes related to school and madrasah resources, parental involvement, community support, and school policies, illuminating their connection to classroom practices and student learning outcomes. The participants selected for this study were balanced by gender and geographical location across all activities – except the local bureaucrats – ensuring that a gender equality, disability and social inclusion (GEDSI) lens was applied throughout the qualitative research process.

However, data on inclusive education services were limited in both districts. To address this limitation, site visits to special education schools in each district were conducted, where principals and teachers were interviewed to highlight challenges and opportunities in providing quality education for students with disabilities. This qualitative data was further contextualized by reviewing relevant district and school reports, and teacher lesson plans.

1.4 Research limitations

One of the research objectives was to apply a GEDSI lens to the analysis. However, the acquired AN data was limited to the school level; therefore, the ability to apply gender-disaggregated data at the student level was restricted. Similarly, student-level disability analysis was a challenge, as there is no tagging on disability in mainstream schools in current AN data. To address these limitations, the research team utilized Dapodik and EMIS data to examine gender-related aspects in schools/madrasahs, such as the gender of school principals and the ratio of female to male teachers, to better understand the relationship

of these elements with student learning. Another limitation in the school/madrasah-level data lies in the use of a binary variable to represent teacher age, which restricts the ability to capture more varied patterns. While sensitivity analyses was conducted across different school types, the data structure did not allow exploration of the possibility of a non-linear relationship between teacher age and student learning outcomes. As a result, potential variations, such as performance peaks at mid-career stages or declines at later stages, could not be empirically tested.

Analysis of madrasah characteristics and students learning was limited due to MTs data being collected as part of a national trial, therefore only about 20 per cent of madrasah characteristics data were available in the AKMI dataset..

Consequently, analysis was limited to investigation of gender disparities in learning outcome between boys and girls in madrasahs and the extent to which parental factors contribute to those gaps.

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2 Results

This section describes the results of quantitative and qualitative data analysis and answers the specific research objectives, which are:

(i) Understanding factors associated with the achievement of students in literacy, numeracy and 21st century skills;

(ii) Understanding factors affecting the gap in literacy, numeracy, and 21st century skills achievement between public and private schools/madrasahs using AN data, and between boys and girls using AKMI data;

(iii) Understanding how these factors shape learning practices in classrooms and school and madrasah settings. The findings are presented in two categories:

(1) Foundational skills

(2) 21st century skills.

2.1 Foundational skills

2.1.1 Primary schools/madrasahs

Factors associated with foundational skills achievement in primary schools/madrasahs

Literacy scores

Table 3 presents the summary of factors that are strongly correlated with literacy scores in primary schools and madrasahs. Among various factors influencing literacy scores for SD and MI students, the strongest predictors for higher learning achievement scores in literacy were (i) the implementation of student-centred national curriculum, (ii) the availability of reading facilities (i.e., libraries), (iii) diverse teacher characteristics (gender, age, education background), (iv) parental engagement; and (iv) positive school and madrasah environments (good classroom management, positive discipline, bullying prevention and positive attitudes towards gender equality and disability inclusion).

Table 3. Factors that are strongly correlated with literacy score in SD and MI

Domains	independent variables	Description of correlation	Similar findings for SD/MI
School/ madrasah characteristics	Status as a public school/madrasah	Status as a public school has negative correlation with literacy scores in SD. This correlation is not prominent for MI.	
	School and madrasah accreditation status	Accreditation status of A and B has positive correlation with literacy scores in SD. However, this correlation was not observed in MI.	
	Internet access	Internet access has positive correlation with literacy scores in SD. No correlation was observed in MI.	
	Availability of library	The availability of a library is positively correlated with literacy scores in MI ($p < 0.01$) and SD ($p < 0.1$).	✓
	Curriculum	The implementation of national curriculum is positively correlated with literacy scores in both SD and MI.	✓
	Gender of School Principal	SD with female principals achieved literacy scores significantly higher (0.149 standard deviations) than those led by male principals. However, the gender of principals had no significant correlation with literacy scores in MIs	
Student characteristics (at school/ madrasah level average)	Parental participation	Parent participation is positively correlated with literacy scores in both SD and MI.	✓
	School and madrasah socioeconomic status (SES)	School socioeconomic status (SES) is positively correlated with literacy scores in SD; however, this relationship was not observed in MI.	
Teacher characteristics (at school/ madrasah level average)	Gender of teachers	The ratio of female teachers to the total number of teachers is positively correlated with literacy scores in both SD and MI.	✓
	Educational level of teachers	The ratio of teachers with a bachelor's degree (S1) or higher is positively correlated with literacy scores in both SD and MI.	✓
	Age of teachers	The ratio of teachers aged 40 years or older is negatively correlated with literacy scores in both SD ($p < 0.01$) and MI ($p < 0.05$).	✓
	Teacher certification Status	The ratio of certified teachers to the total number of teachers in schools is positively correlated with literacy scores in SD. However, this correlation was not observed in MI.	
	Teacher participation in non-PMM training programmes*	While there is a negative correlation between proportion of teachers participated in non-PMM training and literacy scores, the correlation between PMM training and literacy scores is not evident.	
Elements of school/ madrasah transformation (school/ madrasah environment)	Classroom management and positive discipline	A well-organized classroom environment and the implementation of positive discipline are positively correlated with literacy scores in both SD and MI.	✓
	Innovation in teaching practices [4]	Innovation in teaching practices (e.g. the use of new methods, materials, and approaches by teachers to improve instructional quality, encompassing the full cycle of planning, delivery, and evaluation) is negatively correlated with literacy scores in both SD and MI.	✓
	The absence of bullying	Percentage of students reporting feeling safe from bullying is positively correlated with literacy scores in both SD and MI.	✓
	Gender equality	Behaviours that promote gender equality are positively correlated with literacy scores in both SD and MI.	✓
	Educational services regarding students with disabilities	Educational services that reflect knowledge and attitudes regarding students with disabilities are positively correlated with literacy scores in both SD and MI.	✓
	Affectionate attitudes toward disabilities	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, are positively correlated with literacy scores in both SD and MI.	✓

Notes:
- Independent variables with strong correlation (p-value<0.01) with literacy score in SD and MI are shown in the table
- *These independent variables are only available in SD data, not MI data.

4 These factors are explained in the Framework of Learning Environment Survey. Teacher's innovative practice is defined as: the application of means, materials, and/or new approaches in teaching practice, starting from planning, implementation, to evaluation of learning'; which includes reflective statement such as whether or not teachers find new examples to explain an important concept, however difficult for students to understand and whether teachers use new ways to assess students competency levels.

An analysis of school and madrasah characteristics revealed differing relationships with literacy scores for public SD and MI. Several factors- high school accreditation status, internet access, current curriculum implementation, and female principalship-demonstrated strong positive correlations with a higher literacy score amongst SD students. Specifically, SDs with female principals achieved literacy scores significantly higher (0.149 standard deviations) than those led by male principals (see Table A1, Appendix). Although the gender of principals had no significant correlation with literacy scores in MIs, implementation of the national curriculum (1.335 standard deviation) and library availability (0.999 standard deviation) showed notable positive correlations with literacy scores in MIs.

An examination of teacher characteristics showed a negative correlation between the proportion of teachers aged 40 and older and literacy scores in both SDs and MIs, suggesting that teachers' age or level of seniority may pose significant contributing factors to effective learning on literacy. Further analysis indicated a positive correlation between the female teacher ratio and literacy scores in SDs, but not in MIs. Similarly, a positive correlation was observed between the proportion of teachers holding bachelor's degrees and literacy scores in SDs, a relationship less evident in MIs. In SDs, the ratio of certified teachers showed a positive correlation with literacy scores, unlike the non-significant relationship observed in MIs. PMM training participation was found to have insignificant correlation with student literacy scores, whereas participation in trainings other than PMM exhibited a significant negative correlation with literacy scores (see Table A1, Appendix).

In reviewing students' characteristics, a strong positive correlation between parental participation (measured through composite scores of principals, teachers, and students reporting the involvement of parents in planning, developing, and implementing school activities) and literacy and numeracy scores was observed in both SDs and MIs, with the correlation being significantly stronger for MIs. The positive correlation aligns with a meta-analysis of 50 years of research on parental involvement in K–12 education (Kim, 2022), covering both school-based and home-based engagement. Most of the reviewed studies show a positive impact on student achievement in reading/literacy and math, with a stronger effect observed in literacy outcomes.

Furthermore, elements of school and madrasah transformation (school and madrasah environment)- including classroom management, innovative teaching practices, absence of bullying, gender equality behaviours, disability services, and positive attitudes toward disabilities [5] - were assessed. Most of these factors showed a positive correlation with literacy scores in both SD and MI, except for teacher innovative practices, which did not yield a positive relationship.

Numeracy scores

As shown in the summary of findings in Table 4 below, (i) the implementation of the student-centred national curriculum, (ii) diverse teacher characteristics (gender, age, education background), (iii) parental engagement; and (iv) positive school and madrasah environment (good classroom management, positive discipline, bullying prevention and positive attitudes towards gender equality and disability inclusion) positively correlated with numeracy scores in both SDs and MIs, similar to findings for literacy.

In SDs, internet access and accreditation status also positively correlated with numeracy scores; schools with accreditation status of A achieved scores 1.12 standard deviations higher than those without, holding other constants (see Table A1, Appendix).

While higher accreditation levels in SDs are positively associated with numeracy scores, this pattern is not as consistent for MIs. The impact of accreditation on numeracy outcomes was weaker and less consistent for MIs than for SDs. In contrast, for MIs, library availability showed a positive correlation with numeracy outcomes, which did not have significant correlation for SDs. Furthermore, while there was strong positive correlation between literacy scores and gender of school principals in SD, there was no significant correlation for numeracy scores. Several teacher characteristics were found to be significantly correlated with numeracy scores in SDs: the proportion of teachers with bachelor's degrees, the proportion of teachers aged 40 and above, and the certified teacher ratio. The proportion of

5 These factors are explained in the Framework of Learning Environment Survey. Teacher's innovative practice is defined as: the application of means, materials, and/or new approaches in teaching practice, starting from planning, implementation, to evaluation of learning'; which includes reflective statement such as whether or not teachers find new examples to explain an important concept, however difficult for students to understand and whether teachers use new ways to assess students competency levels. Affectionate attitude towards disabilities refers to and includes reflective statements such as whether teachers use individual learning plans for students and whether a school or madrasah has the infrastructure or conditions in support of inclusive education.

Table 4. Factors that are strongly correlated with numeracy score in SD and MI

Domains	independent variables	Description of correlation	Similar findings for SD/MI
School/madrasah characteristics	Status as a public school/madrasah	Status as a public school has negative correlation with numeracy scores in SD. This correlation was not observed in MI.	
	School and madrasah accreditation status	Accreditation status has positive correlation with numeracy scores in SD. This correlation was not observed in MI.	
	Internet access	Internet access is positively correlated with numeracy scores in SD, whereas no correlation was observed in MI.	
	Availability of library	The availability of a library is strongly correlated (positively) with numeracy scores in MI but there is no correlation in SD.	
	Curriculum	The implementation of national curriculum is positively correlated with numeracy scores in both SD and MI.	✓
Student characteristics (at school/ madrasah level average)	Parental participation	Parent participation is positively correlated with numeracy scores in both SD and MI.	✓
	School and madrasah socioeconomic status (SES)	School socioeconomic status (SES) is positively correlated with numeracy scores in SD; however, there is no correlation observed for MI.	
Teacher characteristics (at school/ madrasah level average)	Gender of teachers	The ratio of female teachers to the total number of teachers is positively correlated with numeracy scores in both SD ($p < 0.05$) and MI ($p < 0.1$).	✓
	Educational level of teachers	The ratio of teachers with a bachelor's degree (S1) or higher is positively correlated with numeracy scores in both SD and MI.	✓
	Age of teachers	The ratio of teachers aged 40 years or older is negatively correlated with numeracy scores in both SD and MI.	✓
	Teachers' certification status	The ratio of certified teachers to the total number of teachers at school is positively correlated with numeracy scores in SD. However, this correlation was not observed in MI.	
	Teachers' participation in non-PMM training programmes*	While there is a negative correlation between proportion of teachers participated in non-PMM training and literacy scores, the correlation between PMM training and numeracy scores is not evident.	
Elements of school/madrasah transformation (school/ madrasah environment)	Classroom management and positive discipline	A well-organized classroom environment and the implementation of positive discipline have positive correlation with numeracy scores in both SD and MI.	✓
	Innovation in teaching practices	Innovation in teaching practices is negatively correlated with numeracy scores in both SD and MI.	✓
	The absence of bullying	Percentage of students reporting safe from bullying is positively correlated with numeracy scores in both SD and MI.	✓
	Gender equality	Behaviours that promote gender equality are positively correlated with numeracy scores in both SD and MI.	✓
	Educational services regarding students with disabilities	Educational service provision reflecting knowledge and attitudes regarding students with disabilities are positively correlated with numeracy scores in both SD and MI.	✓
	Positive attitude towards disabilities	Teachers' attitudes toward disabilities are positively correlated with numeracy scores in both SD and MI.	✓
	Affectionate attitudes toward disabilities	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, are positively correlated with literacy scores in both SD and MI.	✓

Notes:
- Independent variables with strong correlation (p-value<0.01) with literacy score in SD and MI are shown in the table
- *These independent variables only available in SD data, not MI data.

teachers with bachelor's degrees had a positive correlation with numeracy scores in SDs and MIs. On the other hand, the proportion of teachers aged 40 and older showed negative correlation in both SDs and MIs. A positive correlation existed between the certified teacher ratio and numeracy scores in SDs, but this relationship was not significant in MIs. Similar to the finding from literacy scores, in SDs, proportion of teachers participated in non-PMM teacher training negatively correlated with numeracy scores, though no significant association was found between PMM training and numeracy scores.

Similar to the literacy findings, most elements of school transformation, which includes classroom management and positive discipline, the absence of bullying, gender equality behaviours, disability services, and affectionate attitudes towards disabilities, all exhibited positive correlations with numeracy scores in SDs and MIs. However, it is noteworthy that teachers' innovative practices demonstrate a negative relationship with numeracy scores. This finding requires further investigation.

In both SDs and MIs, a significant and positive correlation was observed between parental participation and numeracy scores. However, this effect was substantially more pronounced in MIs.

Factors associated with gap in foundational skills achievement between public and private schools in primary schools/madrasahs

This section presents the summary of findings of an Oaxaca-Blinder decomposition analysis, which was used to analyse the literacy and numeracy score gap between public and private schools and madrasahs. This analysis identified variables (independent variables under school characteristics, student characteristics, teachers' characteristics, and elements of school transformation) that explains the gap in literacy and numeracy outcomes between public and private SD and MIs.

Gaps in literacy scores

Comparison of literacy scores between private and public SDs showed that private SDs achieved higher average literacy scores than public SDs, once school-level differences was considered. MIs were not included in this analysis because there was no significant gap in literacy score between public and private MIs.

The Oaxaca-Blinder decomposition analysis found that the literacy score gaps in public and private SDs were most strongly associated with the following four variables: teacher's certification status, innovative teaching practices, teacher's age, and the school accreditation status.

Other variables that showed significant association with the literacy score gap were parents' participation, school's socioeconomic status and internet access in school, as well as the proportion of female teachers, and educational level of teachers (Table A2, Appendix). This suggests that addressing the identified relevant factors, specifically the four major factors, is necessary to effectively narrow the literacy gap between private and public SDs.

Gaps in numeracy scores

Comparison of numeracy outcomes between public and private SDs also showed a significant gap in numeracy scores between private and public SDs, with private SDs achieving notably higher scores. No significant numeracy score difference was observed between private and public MIs.

Similar to the findings regarding the literacy gap, the Oaxaca-Blinder decomposition analysis found that the numeracy score gaps in public and private SDs were also most strongly associated with the following four variables: teacher's certification status, innovative teaching practices, teacher's age, and the school accreditation status.

with literacy score gaps, parents' participation, school's socioeconomic status and internet access in school and teacher's education level were found to be significantly contributing to the numeracy score gaps in public and private SDs. For numeracy, affectionate attitudes towards disabilities was also a variable that had strong association with the score gaps (see Table A2, Appendix). Addressing these factors, such as improving accreditation for both private and public SDs, could help narrow the numeracy gap between the two types of school.

2.1.2 Junior secondary schools/ madrasahs

The specifications in the regression analysis for junior secondary schools and madrasahs differ slightly from those for primary schools and madrasahs. Prior to conducting the multiple regression method, the Lasso approach (see Appendix A) was used to select independent variables at the school/madrasah-level. The junior secondary school/madrasah-level analysis included variables related to the absence of physical discipline and the educator's vision and mission for learning, both reflecting aspects of school

transformation. However, these two independent variables were not used in the primary school/ madrasah analysis.

In the AN data, the educators' vision and mission for learning variable is a composite score that explains how the principal's and teachers' vision and mission to improve learning were developed, understood, and implemented. A higher composite score indicates better formulation, delivery and implementation of educator's vision and mission that focuses on improving learning. In addition to quantitative datasets like the AN, qualitative data were also collected from junior secondary schools/ madrasahs and included in the analysis.

Factors associated with foundational skills achievement in junior secondary schools/ madrasahs

Literacy scores

Table 5 below presents the summary of findings of factors associated with literacy scores in junior secondary schools and madrasahs, presented in more detail in Table A3 in Appendix. Similar to SD and MI, (i) the implementation of student-centred national curriculum, (ii) the availability of reading facilities (i.e., libraries), (iii) positive school environment (disability services and affectionate attitude toward disabilities) are positively correlated with learning achievement scores in literacy for SMP and MTs. Notably, unlike the primary school-level findings where this was observed only in SD, A-level accreditation status shows a significant positive association with literacy scores in both SMP and MTs.

Additional factors positively associated with literacy scores in both SMP and MTs are the proportion of certified teachers, educators' vision and mission for learning, and the absence of physical discipline practices. The latter two variables were examined specifically in the multiple regression analysis for the junior secondary level and showed strong positive correlations with literacy scores. A positive correlation between literacy scores and educators' vision and mission for learning is evident when school principals initiate concrete programs and policies that aim to improve quality of learning at school. Qualitative findings further highlight the role of principal-led initiatives in driving literacy achievement. One notable example is the implementation of a regular literacy program, where students were not only encouraged to read books but also required to summarize their readings. This initiative fostered consistent reading habits and promoted critical thinking skills, especially within the madrasah context.

Furthermore, the proportion of teachers aged 40 years and above, as well as the use of innovative teaching practices, were negatively correlated with literacy scores in both SMP and MTs. The unexpected negative association between innovative teaching practices and literacy outcomes may be attributed to potential omitted variable bias. According to the Framework of Learning Environment Survey published by the Assessment and Learning Center of MoPSE (*Pusat Asesmen dan Pembelajaran*, 2021), the effective implementation of innovative teaching methods should be accompanied by teacher reflection and ongoing professional learning activities. These three components, i.e., innovation, reflection, and continuous learning, are theorized to be mutually reinforcing to improve teaching practice.

However, the use of the Lasso method in the analysis, which reduces variables to prevent overfitting, led to the exclusion of reflection and teacher learning activity variables from the final multiple regression model. Their absence may have influenced the observed outcomes. Future analyses that include those two variables along with innovative teaching practices may show different results.

In the final multiple regression model, the use of innovative teaching practices alone, without accounting for teacher reflection or professional development, was negatively associated with literacy scores. This suggests that the adoption of diverse media and new instructional approaches, when not grounded in reflective practice and skill improvement, may lead to potentially counterproductive effects on student learning. Qualitative findings further support this interpretation, revealing that innovative teaching practices were often implemented in a limited and superficial manner.

Several factors were found to be significant only within either SMP or MTs, but not both. The analysis revealed a negative association between public school status and literacy scores in SMPs: controlling for other variables, public SMPs scored 1.765 standard deviations lower than private SMPs (see Table A3 in Appendix). No such correlation was observed for public MTs.

Within SMPs, several variables showed a positive correlation with literacy scores, including internet access, parental participation, female teacher ratio,

Table 5. Factors that are strongly correlated with literacy score in SMP and MTs

Domains	independent variables	Description of correlation	Similar findings in SMPs/MTs
School Characteristics	Status as public schools	Status as public schools have negative correlation with literacy scores in SMP. In contrast, this correlation was not observed in MTs.	
	Accreditation status	Higher accreditation status is positively correlated with literacy scores in both SMP ($p<0.01$) and MTs ($p<0.05$).	✓
	Internet access	Internet access is positively correlated with literacy scores in SMP, whereas no correlation was observed in MTs.	
	Availability of library	The availability of a library is positively correlated with literacy scores in both SMP and MTs.	✓
	Curriculum	The implementation of national curriculum is positively correlated with literacy scores in both SMP and MTs.	✓
	Gender of principal	A female principal is negatively correlated with literacy scores in MTs ($p < 0.05$); however, this relationship is not observed in SMP.	
Student Characteristics (at school level average)	Parental participation	Parents' participation was positively correlated with literacy scores in SMP, whereas no correlation was observed in MTs.	
	School socioeconomic status (SES)	The school socioeconomic status (SES) was positively correlated with literacy scores in SMP; however, this relationship was not observed in MTs.	
Teacher Characteristics (at school level average)	Gender of teachers	The ratio of female teachers to the total number of teachers was positively correlated with literacy scores in SMP, whereas no correlation was observed in MTs.	
	Age of teachers	The ratio of teachers aged 40 years or older was negatively correlated with literacy scores in both SMP and MTs.	✓
	Teacher certification status	The ratio of certified teachers to the total number of teachers at school was positively correlated with literacy scores in both SMP ($p < 0.01$) and MTs ($p < 0.05$).	✓
	Teacher participation in PMM training programmes*	Proportion of teachers who participated in training via PMM exhibited a positive correlation with literacy scores in SMP.	
	Teacher participation in non-PMM training programmes*	Proportion of teachers who participated in training programmes other than the PMM exhibited a negative correlation with literacy scores in SMP.	
Elements of school transformation (school environment)	Innovation in teaching practices	Innovation in teaching practices based on reflections conducted by teachers was negatively correlated with literacy scores in both SMP and MTs.	✓
	Educators' vision and mission for learning	Articulated and implemented school/madrasah vision and mission, focused on improving learning outcomes, are positively correlated in both SMP and MTs.	✓
	The absence of bullying	Percentage of students reporting safe from bullying was negatively correlated with literacy scores in SMP. In contrast, this correlation was not observed in MTs.	
	Positive discipline	The implementation of positive discipline is positively correlated with literacy scores in SMP and MTs.	✓
	Gender equality	Behaviours that promote gender equality are positively correlated with literacy scores in SMP, whereas no correlation was observed in MTs.	
	Educational services regarding students with disabilities	Educational services that reflect knowledge and attitudes regarding disabilities are positively correlated with literacy scores in both SMP and MTs.	✓
	Positive attitude towards disabilities	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, were positively correlated with literacy scores in both SMP and MTs.	✓

Notes:
- Independent variables with strong correlation (p-value<0.01) with literacy score in SMPs and MTs are shown in the table.
- *This independent variable only available in SMP data, not MTs data.

training via PMM, and gender-equitable behavior. Conversely, training not conducted via PMM and a higher proportion of students reporting feeling safe from bullying were negatively associated with literacy scores and only within SMPs. In contrast, for MTs, the presence of a female principal was negatively correlated with literacy scores, a relationship not observed in SMPs.

Regarding the use of internet access, many teachers have successfully integrated digital resources into their lessons, allowing students to access online materials via their mobile phones. As noted by a Bahasa teacher during a group interview:

> "I typically find teaching materials on YouTube. First, I search for relevant content and select the most suitable videos for the students. I then provide them with the links to watch. Afterwards, they create a script or outline based on what they've learned." (Female junior teacher, SMP in urban area, Maros, 14 May 2024.)

However, a number of madrasah teachers expressed concerns over potential gadget addiction among students. Consequently, this perception led them to avoid incorporating internet usage into their classroom instruction.

The qualitative findings further indicated that differentiated teaching and student-centred learning strategies significantly enhanced student engagement. This aligned with the multiple regression analysis, which showed a positive correlation between the implementation of the national curriculum and learning outcomes in both SMP and MTs. Schools/madrasahs that implemented the national curriculum exhibited greater awareness of differentiated instruction and student-centred pedagogies. As highlighted by a junior teacher from a rural SMP in Magelang:

> "Previously, teachers relied heavily on lecture methods; after adopting active learning and differentiated teaching, our methods have varied to meet diverse student needs." (Female mathematics teacher, Magelang, 21 May 2024.)

The differentiated teaching and student-centred learning strategies introduced by the national curriculum were considered to not only foster higher student engagement, but to also enhance literacy skills, as instruction was better aligned with individual learners' needs. Additionally, the emphasis on active participation and diverse teaching tools reported in the qualitative findings suggested that increased student engagement positively contributed to learning development, with actively participating students tending to grasp concepts more effectively. Teachers from urban SMPs in both sampled districts articulated their views:

> "With the current national curriculum, children can be more creative and explore themselves." (Group discussion with senior teachers, urban, Maros, 15 May 2024.)

> "The national curriculum, which uses differentiated teaching and encourages active learning, is great for kids and parents. Students enjoy it and are excited, even though it requires extra effort from teachers." (Group discussion with junior teachers, urban, Magelang, 14 May 2024.)

Such a supportive environment, fostered by the implementation of the national curriculum, was found to increase motivation amongst students through active engagement in the classroom. In contrast, schools that had not adopted these teaching methods were likely to rely on teacher-centred approaches, resulting in limited student interaction and lower engagement levels.

Numeracy scores

Based on the summary of findings in Table 6 below, the analysis of factors influencing numeracy scores in SMPs and MTs has revealed several key insights. Public school status was negatively correlated with numeracy scores in SMPs, though no correlation was found for public MTs. In SMPs, access to a library, internet, and A-level accreditation status were all associated with higher numeracy scores. For MTs, having a library was strongly associated with higher numeracy scores (high level of significance). While the presence of a female principal was linked to lower numeracy scores at MTs, this relationship was moderately significant. No significant correlation was found between principal's gender and numeracy scores in SMP. The national curriculum, which emphasizes differentiated teaching and student-centred learning, was associated with improved numeracy scores in both SMPs and MTs. This association was moderately strong in SMPs and very strong in MTs.

In SMPs, higher proportions of female and certified teachers were associated with better numeracy scores. In MTs, certified teachers were associated

Table 6. Factors that are strongly correlated with numeracy score in SMPs and MTs

Domains	independent variables	Description of correlation	Similar findings in SMPs/MTs
School Characteristics	Status as public school	Status as a public school has a negative correlation with numeracy scores in SMPs. In contrast, this correlation is not observed in MTs.	
	Accreditation status	Higher accreditation status was positively correlated with numeracy scores in SMPs, whereas no correlation was observed in MTs.	
	Internet access	Internet access was positively correlated with numeracy scores in SMPs, whereas no correlation was observed in MTs.	
	Availability of library	The availability of a library was positively correlated with numeracy scores in both SMPs and MTs.	✓
	Curriculum	The implementation of the current national curriculum was positively correlated with numeracy scores in both SMPs ($p < 0.05$) and MTs ($p < 0.01$).	✓
	Gender of principal	Female principals were negatively correlated with numeracy scores in MTs ($p < 0.05$); however, this relationship was not observed in SMPs.	
Student Characteristics (at school level average)	Parents' participation	Parents' participation was positively correlated with numeracy scores in both SMPs ($p < 0.01$) and MTs ($p < 0.1$).	✓
	School socioeconomic status (SES)	The school socioeconomic status (SES) was positively correlated with numeracy scores in SMPs; however, there was no correlation in MTs.	
Teacher Characteristics (at school level average)	Gender of teachers	The ratio of female teachers to the total number of teachers was positively correlated with numeracy scores in SMPs, whereas no correlation was observed in MTs.	
	Age of teachers	The ratio of teachers aged 40 years or older was negatively correlated with numeracy scores in MTs. In contrast, this correlation was not observed in SMPs.	
	Teacher certification status	The ratio of certified teachers to the total number of teachers at school was positively correlated with numeracy scores in both SMPs and MTs.	✓
	Teacher participation in PMM training programmes*	Proportion of teachers who participated in training via Merdeka Mengajar platform (PMM) exhibited a positive correlation with numeracy scores in SMP.	
	Teachers' participation in non-PMM training programmes *	Teachers who participated in training programmes other than the Merdeka Mengajar platform (PMM) exhibited a negative correlation with numeracy scores in SMPs.	
Elements of school transformation (school environment)	Innovation in teaching practices	Innovation in teaching practices, based on reflections conducted by teachers, was negatively correlated with numeracy scores in both SMPs and MTs.	✓
	Educators' vision and mission for learning	Articulation and implementation of school/madrasah's vision and mission, focused on improving learning outcomes, are positively correlated in both SMPs ($p < 0.1$) and MTs ($p < 0.01$).	✓
	The absence of bullying	Percentage of students reporting safe from bullying was not correlated with numeracy scores in both SMPs and MTs.	
	Positive discipline	Proportion of students reporting safe from physical discipline was positively correlated with numeracy scores in SMPs and MTs.	✓
	Gender equality	Behaviours that promote gender equality were positively correlated with numeracy scores in SMPs, whereas no correlation was observed in MTs.	
	Educational services regarding students with disabilities	Educational services that encompass knowledge and attitudes regarding students with disabilities were positively correlated with numeracy scores in both SMPs and MTs.	✓
	Positive attitude towards disabilities	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, were positively correlated with numeracy scores in both SMPs and MTs.	✓

Notes:
- Independent variables with strong correlation (p-value<0.01) with literacy score in SMPs and MTs are shown in the table.
- *This independent variable only available in SMP data, not in MTs data.

with higher scores, while teachers aged 40 and above were associated with lower scores.

The strong association between teacher certification and student learning outcomes implies the need for more in-depth investigation.

It is important to recognize the common tendency to equate teacher certification with teacher allowance. In our study, we analyze the proportion of teachers who hold certification but do not necessarily receive an allowance. De Ree et al. (2018) found no evidence that teacher allowances improve student learning outcomes. However, they noted that higher pay may, in the future, attract new entrants into the profession, who are typically younger teachers. Since our analysis relies on school level data and focuses on the proportion of certified teachers, the findings may obscure variations across age groups. A more granular analysis that incorporates teacher age could reveal different patterns.

The strong association between teacher certification and student learning outcomes implies the need for more in-depth investigation. It is important to recognize the common tendency to equate teacher certification with teacher allowance. In our study, we analyze the proportion of teachers who hold certification but do not necessarily receive the allowance. De Ree et al. (2018) found no evidence that teacher allowances improve student learning outcomes. However, they noted that higher pay may, in the future, attract new entrants into the profession, who are typically younger teachers. Since our analysis relies on school level data and focuses on the proportion of certified teachers, the findings may obscure variations across age groups. A more granular analysis that incorporates teacher age could reveal different patterns.

Like the literacy findings, the proportion of teachers who received training outside of the PMM programme was also negatively correlated with numeracy scores. Qualitative data from FGDs shed light on this finding. Students frequently reported experiencing classes without the presence of a teacher, which led to boredom and disengagement, and often resulted in them playing or sleeping during unattended periods. Interviews with teachers revealed that one reason for leaving classes unattended is their participation in face-to-face training sessions scheduled during school hours. These disruptions can significantly impact the effectiveness of classroom learning and, consequently, student performance. Therefore, teachers suggested that the timing of training sessions should be adjusted to align with teachers' teaching schedules:

> "Teacher training provided by local education authorities should take the school schedule into account. Teachers are busy with teaching and other responsibilities, so the timing needs to be adjusted. While these capacity-building programmes are helpful, they often overlap with other activities." (Group interview with junior teachers, urban, Magelang, 14 May 2024.)

In terms of school transformation elements, the implementation of non-physical disciplinary measures demonstrates a positive relationship with numeracy scores in both SMPs and MTs.

Furthermore, SMPs that demonstrate strong gender equality behaviours tended to have better numeracy outcomes. Schools and madrasahs that display positive attitudes toward disabilities and provide disability services also positively correlated with numeracy scores in both MTs and SMPs. Conversely, teachers' innovative practices were negatively correlated with numeracy scores in both SMPs and MTs.

A shared vision and mission for learning amongst educators (principals and teachers), was positively correlated with both numeracy and literacy scores in SMPs and MTs. While the relationship between educators' vision and mission for learning was only marginally significant for numeracy in SMPs, it was very strong in MTs.

The principal's role as the instructional leader is crucial, as their vision and mission for learning, shape the school's overall direction and cascade down to teachers, ultimately influencing student outcomes. This finding aligns with the qualitative study, which found that the role of school principals as instructional leaders in enhancing educational quality in both SMPs and MTs is vital. In SMPs, transformational principals (*kepala sekolah Penggerak*) in both rural and urban areas showed stronger initiative in providing regular supervision and support to teachers. This support included offering constructive feedback and promoting reflective teaching practices, significantly contributing to teachers' professional development, and fostering a robust learning culture within schools.

During the qualitative data collection period, the MTs that were visited demonstrated improvements

in numeracy and literacy scores, as reported in the madrasah's own *Rapor Pendidikan* (Education Report). Principals and teachers, as expressed in FGDs and in-depth interviews, attributed these gains to two key factors: (1) effective supervision of teaching practices by the madrasah principals; and (2) the consistent implementation of regular literacy programmes within the madrasahs. For instance, an urban madrasah principal sought assistance from alumni and external partners to supply a diverse range of books for the library. Another MTs principal supports teacher professional development by organizing annual in-house training sessions, encouraging teachers to participate in various online training programmes, such as the platforms provided by MoRA – namely *Pusat Informasi Pelatihan dan Pembelajaran* (PINTAR) – and provides financial support for teachers attending face-to-face training sessions at the district level, whenever available.

Box 1

The importance of combining online and offline training

Achieving school transformation necessitates leveraging tools provided by MoPSE, such as the *Rapor Pendidikan* (Education Report) and the PMM. These resources are essential for enhancing teaching and learning outcomes as they help schools to identify areas that need improvement and to support teacher development.

The quantitative analysis of literacy scores revealed a positive correlation between training using PMM and performance in SMPs, while training through other methods shows a negative correlation. Notably, these quantitative findings are limited to SMPs because data on training via PMM is not available for MTs, which may be due to the use of another platform provided by MoRA (PINTAR). Qualitative data indicated that both SMP and MTs teachers encounter challenges in making online learning effective. Although SMP teachers have largely embraced PMM, madrasah teachers reported a lack of in-person training opportunities. This aligns with insights from INOVASI (2024a), which suggest that despite high participation in online training, online training alone is insufficient to transform teacher practice and needs to be combined with other strategies. Many teachers in our study said that online training is often perceived as inadequate, with some teachers completing the sessions primarily for certification purposes rather than to acquire substantial knowledge.

It was found that a blended learning strategy has been implemented to address teachers' lack of enthusiasm for online training. Once the *Rapor Pendidikan* became accessible, some SMP principals initiated discussions with teachers to analyse the results. This was followed by collaborative sessions where teachers who completed PMM courses shared their knowledge with their colleagues, fostering a culture of continuous learning. Within the newest curriculum framework, this approach exemplifies the implementation of learning communities (*Komunitas Belajar-Kombel*) at the school level.

Factors associated with the gap in foundational skills achievement between public and private schools in junior secondary schools/madrasahs

This section explains the result of Oaxaca-Blinder decomposition analysis, which was used to identify the factors contributing to the literacy and numeracy score gaps between public and private SMPs and MTs. The variables used in this decomposition analysis are the same as those used in the earlier multiple regression for junior secondary schools/madrasahs, using AN 2023 data. This analysis reveals which variables are key to closing the achievement gap between public and private schools. The decomposition method also provided information about unobserved factors influencing the score gap.

Gaps in literacy scores

Literacy scores of SMPs showed that students in private SMPs demonstrated higher average literacy scores than students in public SMPs, once school-level differences was taken into account. The Oaxaca-Blinder decomposition analysis revealed that the three factors with the strongest association to literacy score gaps in SMPs are positive discipline, teacher's certification status, and affectionate attitudes towards disabilities.

Additionally, overall school transformation elements, including factors such as innovative

teaching practice, absence of bullying, gender equality, and disability services, was shown to be strongly contributing to literacy score gaps. Teacher characteristics, specifically the ratios of certified teachers and female teachers, the proportion of teachers aged 40 and above, and the proportions of teachers who had participated in training via PMM and training via other modalities, were also significantly associated with literacy score gaps. Parental participation was also a contributing factor. (Table A4, Appendix)

In contrast to SMPs, literacy score gaps between public and private MTs indicated public MTs to demonstrate higher literacy scores than private MTs. Qualitative findings, based on interviews with MoRA officials at the ministry and at district levels, suggested that the superior performance of public MTs was likely due to the smaller number of public MTs under MoRA's centralized management compared to private MTs. This centralized structure may have allowed for more focused resource allocation. Moreover, MoRA officials mentioned that many small private MTs faced financial difficulties, a challenge echoed by the principals of the madrasahs visited. These principals articulated that financing was particularly difficult given that private madrasahs were often a second choice for parents whose children were not accepted into public schools/madrasahs.

In MTs, A-level accreditation status, positive discipline and affectionate attitudes towards disabilities were three of variables with the strongest correlation to literacy score gaps. In addition, school characteristics that contributed to the literacy gap included library availability and the implementation of the national curriculum. Among teacher characteristics, only the proportion of teachers aged 40 and above was a significant contributing factor to the literacy gap between private and public schools.

While school transformation variables were influential in explaining the SMP literacy gap, only teachers' innovative practices, educators' vision and mission for learning, the absence of physical discipline, disability services, and affectionate attitudes toward disabilities contributed to the literacy gaps in MTs. Despite these differences, both SMP and MTs results underscore the importance of a positive school environment in reducing the literacy gap between public and private institutions.

The decomposition analysis suggested that the proportion of teachers 40 years and above is a salient factor in the literacy achievement gap between public and private SMPs and MTs. To mitigate this, schools could explore strategies such as rebalancing the distribution of senior and junior teachers or implementing mentorship programmes that pair experienced teachers with newer colleagues. This finding aligns with qualitative data from local education stakeholders, who noted age-related differences in teachers' motivation to refine their instructional practices.

> "Those with the drive and capability to move forward faster are the '*guru penggerak*'. They are young, smart, and eager to advance. Meanwhile, some senior teachers, though more experienced, may resist change, often saying, 'It's difficult,' or thinking of retirement instead. Of course, there are senior teachers who excel, but it truly depends on the individual." (Male, BPPMP bureaucrat, Central Java, 16 May 2024.)

> "Younger teachers tend to be more adaptable and innovative, especially in teaching methods and digital literacy. They have the ability to integrate technology into education." (Male, local education agency officer, Magelang, 14 May 2024.)

Gaps in numeracy scores

The Oaxaca-Blinder decomposition results indicated a significant gap between public and private SMPs, with private SMPs showing higher average numeracy scores (see Table A4 in Appendix). This gap was driven by several school-level characteristics, most notably A-level accreditation status, internet connectivity, and the presence of a school library. Implementation of the national curriculum also contributes to the numeracy gap, but at a moderate level. Teacher-related factors, i.e., the proportion of certified and female teachers, and the proportion trained outside the PMM programme, also contributed to the numeracy score gap between public and private SMPs.

Some aspects of school transformation, such as the absence of physical discipline, the availability of disability services, gender-equitable behaviour, and positive attitudes toward disabilities, were strong contributors to the numeracy gap. Meanwhile, the educators' vision and mission for learning also played a role, but with a more moderate influence. Addressing the strongest drivers of disparity can help close the numeracy gap and promote more equitable achievement across public and private SMPs.

In contrast, public MTs achieved higher average numeracy scores compared to private MTs. Two school characteristics helps explain the gap: the availability of a library and the implementation of the national curriculum. As for teacher characteristics, variables contributing to the gap were the ratio of teachers aged 40 years and older and the certified teacher ratio.

Furthermore, certain elements of school transformation, teachers' innovative teaching practices, educators' vision and mission for learning, the absence of physical discipline, disability services, and a positive attitude toward disabilities, have also been identified as contributing factors to the numeracy gap between public and private MTs.

Similar to the literacy gap findings, parental participation was found to contribute to the numeracy gap between public and private SMPs. However, for MTs, parental involvement did not show a statistically significant effect. This indicates that the higher average numeracy scores observed in public MTs compared to private MTs are not attributable to parents' roles in planning, developing, or implementing madrasah activities.

While the numeracy gap between private-public SMPs and private-public MTs can be explained by indicators discussed above, a substantial portion of the difference remains unexplained, as indicated by the Oaxaca-Blinder decomposition results (see Table A4 in Appendix). This unexplained component points to the influence of other unobserved or unmeasured factors that were not captured in the current model. To fully understand the complex dynamics behind these gaps, further research is needed to explore additional variables.

2.2 21st century skills

2.2.1 Factors associated with 21st century skills learning achievement

Table 7 examines the factors that have significant correlation with students' creative thinking and critical reasoning scores in primary and junior secondary schools/madrasahs, focusing on similar findings across SD, MI, SMP, and MTs. Innovative teaching practices and positive attitudes toward disability inclusion show strongest association with these 21st century skills in all education type and level. At the SD and MI level, several additional factors were found to be significantly associated with students' creative thinking and critical reasoning scores. Classroom management, which includes both orderliness and positive discipline, was positively correlated with students' creative thinking and critical reasoning. A well-managed classroom environment, where expectations about learning outcomes are clear and discipline is constructive, appears to foster conditions that support student engagement and higher-order thinking (Lamb et al., 2017). Another important factor is the absence of bullying. The greater the proportion of students reporting feeling safe from bullying by teachers or fellow students within the primary school/madrasah, the more likely they are to demonstrate creative thinking and critical reasoning.

While acknowledging the importance of school resources and teacher profile, a review by Lamb et al., (2017) suggests that pedagogical approaches and the creation of a positive classroom climate are critical factors in fostering 21st century skills. This aligns with our findings across education types and level, variables reflecting a positive and inclusive school environment consistently demonstrate a significant and positive association with students' creative thinking and critical reasoning. In contrast, most indicators related to school resources and teacher characteristics show no significant or inconsistent correlations with creative thinking and critical reasoning scores. These results emphasize the importance of prioritizing teaching practices and school climate over structural inputs alone when aiming to foster 21st century skills.

2.2.2 Factors influencing the gap in 21st century skills

This section summarizes the findings from the Oaxaca-Blinder decomposition analysis of 21st century skills scores in primary and junior secondary schools/madrasahs (see Table A6 and A8 in Appendix). The decomposition identified key factors contributing to the achievement gap in 21st century skills between public and private institutions after adjusting for structural differences. The method highlighting the need for both types of schools to address these factors to ensure equitable educational quality.

At the primary school/madrasah level, the Oaxaca decomposition results showed that public SDs/MIs outperform private SDs/MIs in 21st century skills once differences in school-level characteristics were taken into account. Major factors contributing to the gap in creative thinking and critical reasoning scores between public and private are teachers' innovative teaching practices and positive attitudes

Table 7. Summary of findings of factors associated with 21st Century Skills [6]

Domains	independent variables	Factors associated with creative thinking scores	Factors associated with critical reasoning scores	Similar findings in SD/MI	Similar findings in SMP/MTs
Elements of school transformation (school environment)	Classroom management and positive discipline	A well-organized classroom environment and the implementation of positive discipline were positively correlated with creative thinking scores.	A well-organized classroom environment and the implementation of positive discipline were positively correlated with critical reasoning scores.	✓	
	Innovation in teaching practices	Innovation in teaching practices, based on reflections conducted by teachers, was positively correlated with creative thinking scores.	Innovation in teaching practices, based on reflections conducted by teachers, was positively correlated with critical reasoning scores.	✓	✓
	The absence of bullying	Percentage of students reporting safe from bullying was positively correlated with creative thinking scores.	Percentage of students reporting safe from bullying was positively correlated with critical reasoning scores.	✓	
	Positive attitude towards disabilities	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, were positively correlated with creative thinking scores.	Teachers' attitudes toward disabilities, as determined by affective, cognitive, and behavioural aspects, were positively correlated with critical reasoning scores.	✓	✓

Note:
Independent variables with strong correlation (p-value<0.01) with literacy score in SMPs and MTs are shown in the table.

toward disabilities. Additionally, there is moderate evidence that classroom management, which include practices that promote orderliness and positive discipline, contributes to the score gap in 21st century skill.

In junior secondary schools and madrasahs, Oaxaca decomposition results revealed a significant gap in 21st century skills between public and private institutions, across both SMP and MTs. Positive attitude towards disabilities emerged as a key driver of the gap in students' creative thinking and critical reasoning scores between private and public SMPs and MTs. This disparity was further shaped by the presence of innovative teaching practices, and by the absence of physical discipline.

In summary, to close the gap in 21st century skills scores between public and private schools and madrasahs, at both the primary and junior secondary levels, it is essential for these institutions to foster a safe and inclusive school environment.

Box 2

Why are teachers' innovative practices correlated more with creative thinking and critical reasoning than literacy and numeracy?

A key challenge in education is ensuring that innovative teaching methods respond to the needs and situation of the students and that these methods are delivered effectively to enhance the learning process for improved learning outcomes. This issue is illustrated by the experience of an Indonesian language teacher from an urban MTs in Magelang, who noted:

> "I once tried arranging the students' seats in a face-to-face setup, but it actually caused the students to lose focus on the lesson. I thought this [innovation] would enhance learning outcomes because I often see on social media ways to make learning more enjoyable and focused. However, the results did not meet my expectations." (Indonesian language teacher, urban MTs, Magelang.)

6 Only variables that have been found to have significant association are included in the table.

Analysis of lesson plans revealed that teachers adopted various innovative teaching methods such as discovery learning, differentiated instruction, and inquiry-based learning. However, FGDs with students indicated that, in every school and madrasah, some teachers still rely on traditional teacher-centred approaches. This sentiment was echoed by a representative of a school committee, who explained:

> "The quality of teachers and their teaching methods tends to remain unchanged and monotonous, relying heavily on teacher-centred methods. Changing this is challenging because it depends on individual teachers and their willingness to improve their quality and competence." (Parent, rural SMP, Maros.)

In group interviews, many teachers admitted that the innovations they introduced in the classroom were often superficial, primarily involving the use of projectors, mobile phones, laptops, or the internet as instructional resources. Although these technologies aimed to make lessons more engaging, their integration did not significantly alter the traditional lecture-based approach. This observation aligns with findings from an OECD (2019) study, which stated that such superficial innovations in literacy and mathematics instruction do not always lead to improved learning outcomes.

While this study did not find innovative teaching practices to correlate with learning outcomes, results did show that they positively correlate with students' creative thinking and critical reasoning skills. We identified several instances where teachers expressed effective delivery of innovative practices such as through incorporating technology and inquiry-based learning, which, according to Rahmi et al. (2019), are recognized as methods for fostering students' critical reasoning.

For example, an MT teacher in Magelang utilized film as a teaching tool for the Indonesian language. After watching a film, the teacher assigned students the task of summarizing the storyline, which aimed to enhance their comprehension and critical reasoning abilities. The teacher further integrated inquiry-based learning to stimulate critical reasoning, as expressed during a group interview:

> "In my opinion, using the inquiry method in my class is more effective. Students can choose their own sources of information based on their interests. They are encouraged to use their phones to search for materials or find information from various books. This way, they can acquire knowledge independently, with the teacher acting only as a facilitator." (Male teacher, urban area, Magelang, 17 May 2024.)

Another teacher concurred, emphasizing the significance of independent learning:

> "I agree; when it comes to literacy, students should search for information on their own rather than relying on one book. This approach allows their knowledge to expand beyond a single source. When searching for reading materials, they can use their phones."
> (Female teacher, urban area, Magelang, 17 May 2024.)

These examples illustrate that while innovative teaching methods may not always lead to immediate improvements in learning outcomes, they play a critical role in developing students' creative thinking and critical reasoning skills. Moreover, this suggests the need for further study of the literacy and numeracy assessment itself; whether skills such as critical thinking and reasoning are embedded in the assessment or whether more focus is placed in memorization and applying a formula. Overall, the findings underscore the importance of balancing innovation with a focus on fostering deeper, long-term changes in instructional practices that can ultimately lead to improved learning outcomes.

2.3 Foundational skills: analysis of AKMI data

As mentioned in section 1.4, there are limitations to conducting the quantitative analysis with the AKMI data. While we were able to understand factors associated with literacy and numeracy with student-level data, the information was not sufficient to explain madrasah or teacher characteristics. Consequently, we aimed to investigate gender disparities in learning between boys and girls and the extent to which parental factors contribute to those gaps.

2.3.1 *Madrasah Ibtidaiyah* (MI)

Factors associated with literacy and numeracy scores in MI

Our regression analysis showed that girls in MI outperform boys in literacy and numeracy (see Table A9 in Appendix). The findings also indicated that the educational attainment of fathers significantly correlates with the literacy and numeracy scores of students. This correlation was found to be stronger when fathers had higher education, compared to those who only had junior secondary school education. Similar patterns between mothers' educational attainment and students' literacy and numeracy scores were also observed for students in AKMI.

Family income is differentially associated with student achievement, depending on household earnings. At the MI level, monthly income below Rp3,000,000 is negatively associated with literacy scores, with the strongest negative effect observed for households earning under Rp500,000. For numeracy, the negative correlation is significant only for income below Rp2,000,000. The positive association with literacy and numeracy in MI becomes evident from Rp2,000,000, peaking in the highest scores among students from family with income above Rp5,000,000.

No significant correlation was found between these scores and school location (mountainous or coastal, with lowland as the reference category) or school type (public vs. private madrasah).

Factors associated with the literacy and numeracy scores gap between girls and boys in MI

Findings from analysis of literacy and numeracy score gaps between girls and boys in madrasahs shows that there is a significant difference in scores between girls and boys in MIs, with girls outperforming boys. (see Table A9 in Appendix). However, the limited number of available covariates means that neither parental characteristics nor the characteristics of madrasahs, such as geographical location or public status, can explain the gap. This suggests the need for further research to understand if additional factors at the madrasah level potentially contribute to the gaps.

2.3.2 *Madrasah Tsanawiyah* (MTs)

Factors associated with literacy and numeracy scores in MTs

Analysis of AKMI 2023 data reveals several factors associated with literacy and numeracy scores in MTs (see Table A9 in Appendix). Girls outperformed boys in both areas. Higher levels of education amongst fathers significantly improved literacy scores. However, no such relationship was found between fathers' education and numeracy scores, or between family income and numeracy. Mothers with university degrees and madrasah in coastal location positively correlated with numeracy scores. In MTs, the positive association between family income with scores becomes evident from income above Rp1,000,000. On the other hand, numeracy scores in MTs appear unaffected by income, indicating that other factors (e.g., madrasah quality) may have a stronger role at this level.

Factors associated with the literacy and numeracy scores gap between girls and boys in MTs

Similar to the findings at the MI level, the decomposition results showed disparities in numeracy and literacy, with girls outperforming boys. However, the observed factors (i.e., parental characteristics, geographical location of madrasahs, and the public status of the madrasah) were insufficient to explain a significant portion of these gaps. The substantial and significant coefficient for unexplained factors indicates a need to include additional madrasah-level variables in future analyses.

2.4 Qualitative findings on safe and inclusive learning environment

The Sustainable Development Goals (SDGs), particularly Goal 4, emphasize the critical importance of providing safe and inclusive learning environments as a fundamental aspect

of quality education. This goal seeks to ensure that all learners can access equitable and inclusive education, promoting lifelong learning opportunities for everyone, regardless of background or circumstances. SDG 4 underscores the need for educational facilities that are safe, responsive, and supportive, which are vital for fostering a positive learning atmosphere where students can thrive.

Similarly, the Convention on the Rights of the Child (CRC), ratified by Indonesia in 1990, emphasizes the importance of providing a safe and inclusive educational environment for all children. Key articles in the CRC affirm every child's right to education that is free from discrimination and that promotes their overall wellbeing and development. The CRC not only recognizes the right to access education but also emphasizes that education should foster the development of a child in an atmosphere of peace and tolerance. The principles outlined in the CRC and the commitments in the SDGs create a comprehensive framework that prioritizes safe and inclusive learning environments, recognizing their vital role in enhancing educational outcomes.

In Indonesia, the government continues to demonstrate its commitment in transforming the education system to achieve quality and equitable education. The government's commitment to equitable education is reflected in a series of comprehensive policies and initiatives aimed at ensuring access and fostering inclusivity for all students, regardless of their socio-economic status, physical abilities, or vulnerabilities. This holistic approach is evident in regulations such as the Regulation of the Minister of Education, Culture, Research, and Technology (Permendikbudristek) No. 46/2023, which aims to prevent and address all forms of violence in educational environments. This regulation aims to protect students from physical, verbal, and sexual abuse and to create a comfortable learning atmosphere for all. By addressing various forms of violence comprehensively, the regulation supports the holistic wellbeing of students and teachers, recognizing that a safe environment is fundamental for learning.

To complement this effort, the Ministry of Education issued regulation No. 48/2023, emphasizing the importance of inclusive education. This policy mandates that educational institutions facilitate the needs of students with disabilities, ensuring equal access to learning opportunities regardless of the learner's physical or mental condition. Provisions for tailored facilities, resources, and teaching methods that align with the diverse needs of students, are included in this regulation.
Altogether, these regulations reflect a broader vision for transforming Indonesia's education system. By addressing safety, inclusivity and equity, these policies aim to create an environment where all students can thrive. Fostering a safe and inclusive learning environment that accommodates the diverse needs of all learners is essential, and can enhance students' literacy, numeracy, and 21st century skills such as critical reasoning and creative thinking. Our quantitative findings showed that factors representing a safe and inclusive school environment (i.e., the absence of bullying, the absence of physical discipline, supportive attitude towards disabilities) significantly affect those skills and contribute to the gaps between public and private schools/madrasahs. However, the qualitative findings from this study revealed that the implementation of these policies often encounter several challenges.

2.4.1 Safe learning environment

Bullying remains a significant issue in Indonesia, negatively impacting students' motivation, mental health, and overall academic performance. SMP teachers in Maros and Magelang districts acknowledge that one of the factors contributing to the fluctuation of scores in the Education Report (*Rapor Pendidikan*) is the school environment, where bullying continues to be prevalent. This aligns with quantitative findings regarding the correlation between bullying and academic achievement. Findings from our qualitative study highlight that across educational settings (SMPs/MTs) in urban and rural areas, incidents of bullying, whether verbal or physical, are perceived to be quite common.

> "In every class where I served as a homeroom teacher, there was always [bullying]. For instance, there was a girl who was continuously verbally bullied, which led her to attend school intermittently—one week in school, the next week she would be absent, and so on." (Group interview with teachers, urban SMP, Maros, 15 May 2024.)

Bullying contributes to a hostile school environment, instilling fear and insecurity in victims, which frequently results in disengagement from learning and adversely affects academic performance. In extreme instances, this may lead to students dropping out of school.

During FGDs with students, it was found that, although some incidents of bullying were reported to teachers and addressed with positive disciplinary measures, there remains a gap in how bullying is perceived and handled. For instance, a teacher in an urban SMP in Maros district advised a student 'not be offended' when the student reported a peer's physical taunt, implying that the issue was not serious. Similarly, in a rural SMP in Magelang, students reported reluctance to report bullying incidents to teachers, fearing retaliation from peers within exclusive social groups.

The lack of shared understanding between teachers and students about what constitutes bullying may discourage students from reporting incidents, thereby perpetuating the problem. FGDs with female students at a rural MT further highlighted a concerning pattern; teachers frequently overlooked or failed to intervene in bullying cases, particularly when multiple students were involved as perpetrators. This lack of support can make students feel unsupported, potentially exacerbating feelings of vulnerability and discomfort in the school environment. The lack of consistent and empathetic responses to bullying incidents, emphasizes a critical need for clear, well-articulated anti-bullying policies and training to ensure that all teachers, students, and parents have an aligned understanding about bullying to foster a learning environment where students feel safe and respected.

2.4.2 Inclusive education

Indonesia's national legal framework, particularly Law No. 8/2016 on Persons with Disabilities, guarantees the right of individuals with disabilities to access quality education across all levels and types of educational facilities. This includes mainstream and special schools (*Sekolah Luar Biasa* - SLB), with an emphasis on reasonable accommodation to support students with disabilities (INOVASI, 2024b).

Similarly, the district governments of Magelang and Maros have taken steps to align their regulations with national standards, reflecting a strong commitment to inclusive education. These two districts, which were the locus of the qualitative study, have also made efforts to mainstream inclusive education through the regulations of the Kabupaten Head (Bupati) of Magelang No. 16/2022 and Maros No. 19/2023. These district regulations demonstrate the government's commitment to expanding access to educational opportunities for students with disabilities.

However, creating an inclusive learning environment remains a significant challenge, especially for teachers working with children with disabilities. Guidelines for implementing inclusive education, published by MoPSE's Education Standards, Curriculum, and Assessment Agency (*Badan Standar, Kurikulum, and Asesmen Pendidikan*—BSKAP) recommend designing learning environments based on flexible and adaptive principles. This ensures that teaching practices can be tailored to the conditions, characteristics, and needs of learners (Kemendikbudristek, 2022). Yet, despite these regulatory frameworks that emphasize the importance of tailoring education to individual abilities, the implementation of inclusive education practices in the classroom has proven difficult.

The challenges around implementing inclusive education often stem from lack of support and guidance from local authorities, shortage of teaching materials, and insufficient knowledge exchange between special schools and regular schools/ madrasahs. These teachers frequently experience confusion about the appropriate methods of instruction. As one teacher in a group interview shared:

> "We have yet to find an effective way to fulfil the needs of children with disabilities, despite regulations emphasizing the significance of tailoring education to individual abilities. However, putting this into teaching practice is challenging, especially because we are responsible for 32 pupils in a classroom." (Group interviews, SMP Y, Magelang, 14 May 2024.)

One of the significant barriers to the effective implementation of inclusive education is the lack of diagnostic assessments and professional teacher training. These significantly hinder the provision of inclusive education. Teachers expressed the necessity for psychological evaluations performed by professionals, which would help to identify the type of impairment and inform appropriate teaching strategies. However, such assessments are currently either non-existent or conducted informally by the teachers themselves.

Teachers, especially those with no background in special education, often find themselves unsure of the best methods for instructing students with disabilities.

> "Actually, clinical psychological assessment

is the foundational basis for the (inclusive) services to be provided, but it has not been implemented yet. The assessments (so far) have only been conducted by teachers, so teachers evaluate (students) based solely on their very limited knowledge." (Group interviews, special education teachers, Magelang, 22 May 2024.)

Despite these challenges, the qualitative study identified several emerging practices in which teachers make significant efforts to deliver effective instruction to students with disabilities. In an urban SMP, teachers integrate students with disabilities into group activities with their peers, while actively monitoring their understanding of the material. Teachers also raise awareness and promote understanding among students about the special needs of students with disabilities, highlighting the importance of providing support and accommodating their peers. In another school, teachers provide supplementary lessons outside of regular school hours to help students with disabilities to better grasp the lesson content.

2.4.3 Social inclusion for students from low socioeconomic background

The relationship between family background and learning outcomes plays a critical role in shaping student learning outcomes. A senior teacher from Maros district highlighted this dynamic, stating:

> "Family background does influence literacy and will be carried over to school, for example, they (students) come from farming families who need to help their parents, when they come home from school they have to go to the rice fields directly, they also end up being less understanding that reading is important." (Group interview, senior teachers, Maros, 17 May 2024)

AKMI data indicated that family income below Rp500,000 exhibits a negative correlation with reading and numeracy achievement, underscoring the link between socioeconomic factors and student performance. This analysis aligns with the observations made by a local education officer, who said:

> "Literacy and numeracy are significantly influenced by the surrounding environment. Numeracy literacy tends to be lower in rural areas because children's activities are often centred around helping their parents in fields and ponds, leaving little time or opportunity for learning. This dynamic is particularly pronounced among boys." (In-depth interview, Head of Junior High School Development Division, Maros Regency Education Office, Maros, 16 May 2024)

Economic barriers also negatively impact students' time allocation for learning. Some children in the sampled schools and madrasahs reported that they frequently have to assist their parents in earning money, which restricts their study time both at school and at home. Families from low socioeconomic backgrounds, who prioritize meeting basic economic needs, tended to not be deeply involved in improving their children's literacy and numeracy skills.

To address this, schools have begun implementing strategies such as creating WhatsApp communication groups, holding regular parent-teacher meetings, organizing parenting classes, and inviting parents to serve as resource persons during project-based learning activities. However, at SMP and MT levels, parental involvement often remains limited to financial contributions for infrastructure development rather than active engagement in their children's learning. This limitation is partly due to parents' lower educational levels, which hinders their ability to assist with more advanced lessons. As a result, children from low socioeconomic families often lack adequate learning support at home, with parents relying heavily on teachers for their children's education.

3 Key findings and recomendations

The findings reveal a complex interplay of factors impacting educational outcomes, highlighting both consistent trends and notable differences across school and madrasah types (public/private, SD/MI, SMP/MTs). This section synthesizes key findings and presents targeted recommendations for policy and practice.

3.1 Key findings

3.1.1 Literacy and numeracy

1. In primary schools (SD) and *Madrasah Ibtidaiyah* (MI), the implementation of a student-centred national curriculum, parental participation, higher ratio of female teachers, teachers' education level and age, and a positive learning environment were key factors that are positively associated with literacy and numeracy learning scores.
2. In junior secondary schools (SMP) and *Madrasah Tsanawiyah* (MTs), the implementation of a student-centred national curriculum and positive learning environments that applies positive discipline and promotes a supportive attitude and services for students with disability were also found to have a significant positive correlation with literacy and numeracy scores. Additionally, the availability of a library, teachers' certification status, and educators with a vision and mission for learning were factors that were positively associated with literacy and numeracy outcomes at the junior secondary level.
3. Access to the internet had varying impact on student learning outcomes. Findings show that internet access was positively correlated with literacy and numeracy in SDs but not in MIs. Similarly, at junior secondary level, internet access only showed positive correlation with learning outcomes in SMPs and not in MTs. Qualitative study findings indicated that this may be related to madrasah teachers' concerns around potential gadget addiction, which led to some of them avoiding the use of digital devices in classroom instruction.

4. Gender analysis indicated that SDs with female principals achieved literacy scores significantly higher than schools with male principals. While this correlation is significant at the primary level, qualitative findings from SMP and MTs suggest that principal leadership, regardless of gender, plays a critical role in shaping learning outcomes. In these settings, principals actively initiate and implement school programs aimed at improving student learning, demonstrating that strong instructional leadership and shared educational goals may be more influential than gender alone.
5. For all types of schools at primary levels, a higher ratio of female teachers positively correlates with higher scores in both literacy and numeracy. While in junior secondary level the positive correlation only appears in SMP.
6. Gender analysis among students was only available for MI and MTs, using the AKMI data. The data showed that girls in MI and MTs outperformed boys in literacy and numeracy. While the analysis accounts for several school-level (school location and public-private status) and family-level variables, a significant portion of the gender gap remains statistically unaccounted for. This suggests the need for more varied data at school-level and student-level to better understand the underlying drivers of gender disparities in learning achievement in madrasah.

3.1.2 21st century skills

1. In primary education, both SD and MIs showed that elements of school transformation-including classroom management with orderliness and positive discipline, teachers' innovative practices, a safe environment free from bullying, and supportive attitudes toward disabilities-demonstrate significant positive correlations with creative thinking and critical reasoning scores.
2. In junior secondary education, the implementation of innovative teaching practices and supportive attitudes toward disabilities positively correlated with creative thinking and critical reasoning scores in both SMP and MTs.
3. At both primary and secondary levels, teachers' innovative practices were positively correlated with creative thinking and critical reasoning, even though innovative teaching practice had negative correlations with literacy and numeracy scores. Qualitative findings showed that teachers tried to adopt teaching methods such as discovery learning, differentiated instruction, and inquiry-based learning; however, students in all schools and madrasahs shared that there are teachers who still rely on traditional teacher-centred approaches. While innovative teaching may not lead to immediate improvement in learning outcomes, its positive correlation with creative thinking and critical reasoning suggests an opportunity for positive impact on student learning through careful and effective implementation.

3.1.3 Learning gaps between public and private schools

1. At the primary education level, there was no significant difference in literacy and numeracy scores between private and public MIs. However, private SDs achieved higher literacy and numeracy scores than public SDs. Findings showed that these gaps in literacy and numeracy scores were most strongly associated with teachers' certification status, the age of teachers, and school accreditation status.
2. In junior secondary education, private SMPs had higher scores in both literacy and numeracy than public SMPs. In contrast, public MTs demonstrated higher literacy and numeracy scores than private MTs. Despite this difference, the factors most strongly associated with the score gaps between public and private schools were similar for SMPs and MTs. A quality learning environment applying positive discipline and promotes positive attitudes towards disabilities was found to be strongly associated with the score gaps in public and private schools and madrasahs.
3. The stronger performance in literacy and numeracy of public MTs compared to private MTs may be partly explained by findings from the qualitative analysis, which revealed that many private MTs are small-scale institutions struggling with financial constraints. This suggests that teachers in private MTs may lack quality capacity development opportunities and that there are inadequate resources in the private MTs to establish a quality learning environment. Additionally, a smaller number of public madrasahs are directly managed by MoRA, which may enable the public MTs to have better access to centralized support, such as teacher training and learning resources.

3.2 Recommendations

1. **Ensure equitable and effective implementation of the national curriculum with support from national and subnational governments.**
   National and subnational governments should provide consistent support to all schools and madrasahs for effective implementation of the national curriculum. This includes the delivery of quality professional development opportunities for teachers alongside the provision of learning resources to classrooms and school libraries. There should also be a clear quality assurance system to monitor the effective implementation of differentiated teaching, student-centred learning, innovative teaching practice, and positive discipline in classrooms.

2. **Improve teacher effectiveness through data-driven policy.**
   Education policy should be informed by data to enhance effectiveness. Findings relating to teacher characteristics and learning outcomes suggest that there should be a balanced deployment of teachers under 40 years of age and those above 40, to optimize each teacher's skills and experience. The strong association between teacher qualification and certification and learning outcomes implies the importance of examining this aspect in more in-depth. Furthermore, qualitative data suggests the effectiveness of a blended learning approach for teachers. Through this approach, teachers who complete online training conduct offline sessions with other teachers to share their knowledge, thereby fostering a culture of continuous learning. Furthermore, teachers need to be supported to more effectively understand and use *Rapor Pendidikan* results, to assist in the application of individualised student learning. This is where the instructional leadership of principals becomes important, helping translate data into meaningful strategies that drive improvements in teaching and learning.

3. **Accelerate the development of a positive and inclusive learning environment.**
   A comprehensive support system should be established to promote inclusive and supportive school environments. This includes developing a mechanism for disability assessment and referral mechanisms in every district in collaboration with experts, and training teachers on the effective use of these assessment tools. Teachers should also be trained in inclusive education, the effective management of children with disabilities, and the promotion of zero tolerance for bullying. Furthermore, there is need for increased support from local governments, such as provision of accessible facilities, appropriate teaching materials, and professional guidance. Additionally, collaboration among special schools, regular schools or madrasahs, local authorities, and community stakeholders should be promoted to support the exchange of best practices and shared resources.

4. **Strengthen gender-responsive school leadership.**
   Education authorities should review and revise policies and regulations that hinder the advancement of women to school leadership roles. District offices should support and strengthen functional school principal working groups (Kelompok Kerja Kepala Sekolah - KKKS) to foster learning communities, following the model of *komunitas belajar* (learning community), a collaborative group of teachers who regularly meet to share experiences, reflect on teaching practices, and improve the quality of learning in their schools or education settings. Additionally, district offices should provide continuous professional development for principals, focusing on instructional leadership and collaboration with parents and communities.

5. **Conduct further analysis on school accreditation and its impact on learning outcomes.**
   Given the inconsistent relationship between school accreditation status and student outcomes in literacy, numeracy, and 21st century skills across different types of schools and levels, further research is needed. Moreover policymakers should be cautious in referring to accreditation as a primary driver for improving learning outcomes, as previous studies have highlighted its limitations (World Bank, 2020).

6. **Conduct a more in-depth gender-based analysis of student performance.**
   A more detailed analysis of student performance by gender is necessary using both the *Asesmen Nasional* (AN) and *Asesmen Kompetensi Madrasah Indonesia* (AKMI) datasets, to further understand gender-based needs and situation relevant to learning outcomes. Current school-level data provides limited opportunity to unpack student gender-related issues arising from the implementation of the national curriculum. Going forward, data analysis should incorporate more school-based and household-level variables to better understand gender disparities and its challenges. An in-depth, gender-based student performance analysis is also important to ensure the effective implementation of the national curriculum, which promotes student-centred teaching.

7. **Further examine the impact of internet access on learning outcomes.**
   The study showed varied results regarding the relationship between internet access and student learning outcomes, highlighting the need for further in-depth study. Future research should explore context-specific approaches for integrating digital learning, taking into consideration the different school types and local conditions.

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Appendices

Appendix A. Quantitative method

Multiple regression method

Multiple regression is a statistical method used to analyse the relationship between a single dependent variable and multiple independent variables (Gujarat, 2012). The dependent variable is the variable of interest (Y_i) which includes literacy, numeracy, creative thinking, and critical reasoning scores. The independent variables (βn_i) are the factors that may be associated with the dependent variable, which include school characteristics, teachers' characteristics, elements of school transformation, and parents' characteristics. The analysis produces an equation that predicts the dependent variable based on the independent variables. This equation includes coefficients for each independent variable, indicating the strength and direction of the relationship between that variable and the dependent variable.

$$Y_i = \alpha_i + \beta_{1i} + \beta_{2i} + \beta_{3i} + u_i$$

The multiple regression method in this study is used for relationship analysis and controlling for confounding variables.

Prior to the multiple regression method, considering the large number of variables in AN 2023 data, Lasso (Least Absolute Shrinkage and Selection Operator) (Tibshirani, 1996) was used. It is a technique used in statistics and data analysis to help improve the accuracy of predictions while also simplifying models. Lasso works by adding some penalty when the regression includes too many variables. This penalty encourages less significant variables to have their association reduced to zero, effectively removing them from the model. As a result, the final regression model ends up being simpler and focuses only on the most important factors. This also makes the model easier to understand and interpret.

Oaxaca-Blinder decomposition

The initial use of Oaxaca-Blinder decomposition was to analyse the gaps in mean differences of wages between groups, partitioning the wage difference into two components (Fortin et al., 2011; Jann, 2008). The first component, known as the 'explained' part, represents the portion of the gap that can be attributed to observable characteristics that differ between the two groups. These characteristics can include various factors such as education level, work experience, skills, and other relevant attributes. When a significant portion of the gap is found to be explained, it suggests that the differences in observable characteristics, such as qualifications or experience, are substantial contributors to the disparities in outcomes.

The second component, referred to as the 'unexplained' part, refers to the portion of the gap that cannot be attributed to differences in observable characteristics. This portion reflects disparities in how these characteristics are valued or rewarded within the labour market or educational systems. A large unexplained component may imply the presence of unobservable factors, such as discrimination, differing expectations, or institutional biases that negatively affect outcomes for one group compared to another. Furthermore, some research has adopted the Oaxaca-Blinder method to decompose learning test results, as seen in studies by Arteaga and Glewwe (2017), Krieg and Storer (2006), and McEwan and Marshall (2004).

Using AN data, we wished to find out what causes the average score gaps in literacy, numeracy, and 21st century skills between public schools/madrasahs (shown as A) and private schools/madrasahs (shown as B) by regressing the average school-level scores on a number of covariates. While using AKMI data, we aim to decompose what causes the numeracy and literacy scores discrepancies in madrasahs between girls and boys.

$$Y_{Ai} = X'_{Ai}\beta_A + \varepsilon_{Ai} \quad (1)$$

$$Y_{Bi} = X'_{Bi}\beta_B + \varepsilon_{Bi} \quad (2)$$

Equations (1) and (2) provide the estimate of each school's average score (for AN data) or student's score (for AKMI data), denote as $\overline{Y_i}$, which is determined by a vector of variables ($\overline{X'_i}$) separately for unit in group A and B. Since the regression lines pass through the variables' means, we can obtain the mean value of the test for each group as follows:

$$\overline{Y}_A = \overline{X'}_A \hat{\beta}_A \tag{3}$$

$$\overline{Y}_B = \overline{X'}_B \hat{\beta}_B \tag{4}$$

Where $\overline{Y}$ and $\overline{X}$ are the means of the test scores and covariates for each group respectively, and $\hat{\beta}$ values are the coefficient estimates from the regressions, we can then estimate the test score gaps as follows:

$$\bar{Y}_A - \bar{Y}_B = \overline{X'}_A \hat{\beta}_A - \overline{X'}_B \hat{\beta}_B \tag{5}$$

$$\bar{Y}_A - \bar{Y}_B = (\overline{X'}_A - \overline{X'}_B)\hat{\beta}_A + \overline{X'}_B(\hat{\beta}_A - \hat{\beta}_B) \tag{6}$$

$$\bar{Y}_A - \bar{Y}_B = (\overline{X'}_A - \overline{X'}_B)\hat{\beta}_B + \overline{X'}_A(\hat{\beta}_A - \hat{\beta}_B) \tag{7}$$

Equation (5) can be rearranged into equations (6) and (7), depending on which group we choose as the reference group. The first part of equations (6) and (7) represents the 'explained' portion of the Oaxaca-Blinder decomposition, while the second part represents the 'unexplained' portion. Since these two alternative decompositions can yield different results, we will present the outcomes from both results to assess whether they exhibit a similar pattern of results.

Appendix B. Regression and decomposition results

Table A1. Literacy and Numeracy Scores in Primary Schools (AN 2023)

	Literacy scores		Numeracy scores	
	SD	MI	SD	MI
School status	-1.502*** (0.075)	-0.269 (0.435)	-1.350*** (0.078)	-0.125 (0.429)
Accredited C	-0.917*** (0.182)	-3.105 (2.200)	-0.638*** (0.177)	-1.304 (2.015)
Accredited B	0.450*** (0.134)	-2.174 (2.057)	0.501*** (0.132)	-0.229 (1.920)
Accredited A	1.250*** (0.134)	0.166 (2.055)	1.123*** (0.133)	0.783 (1.926)
Library (=1)	0.117* (0.066)	0.999*** (0.331)	0.012 (0.071)	1.652*** (0.316)
Internet access	0.814*** (0.085)	0.013 (0.679)	0.645*** (0.087)	-0.033 (0.668)
Merdeka curriculum	0.231*** (0.047)	1.335*** (0.295)	0.207*** (0.051)	1.255*** (0.290)
Principal gender (Female=1)	0.149*** (0.047)	-0.488 (0.304)	0.080 (0.051)	-0.238 (0.296)
Parents' participation	1.231*** (0.085)	4.141*** (0.703)	0.961*** (0.090)	3.567*** (0.640)
Students-school SES	0.926*** (0.083)	1.313 (0.818)	0.675*** (0.087)	1.168 (0.763)
Female teacher ratio	0.200*** (0.033)	0.804*** (0.270)	0.087** (0.035)	0.502* (0.262)
Bachelor's degree teacher ratio	0.359*** (0.091)	1.241*** (0.457)	0.450*** (0.090)	1.136*** (0.440)
Age 40+ teacher ratio	-0.316*** (0.029)	-0.649** (0.256)	-0.286*** (0.031)	-0.807*** (0.249)
Certified teacher ratio	0.468*** (0.031)	-0.010 (0.194)	0.385*** (0.033)	0.243 (0.187)
Training via PMM	0.035 (0.022)		0.007 (0.024)	
Training NOT via PMM	-0.215*** (0.033)		-0.179*** (0.036)	
Classroom management and positive discipline	1.178*** (0.070)	2.612*** (0.474)	1.501*** (0.074)	2.955*** (0.459)
Teachers' innovative practices	-1.621*** (0.054)	-4.637*** (0.436)	-1.135*** (0.058)	-3.368*** (0.429)
No bullying	1.239*** (0.039)	2.948*** (0.236)	1.371*** (0.040)	2.986*** (0.221)
Gender equality behaviour	0.639*** (0.079)	1.431*** (0.471)	0.490*** (0.077)	1.240*** (0.444)
Disability services	0.096*** (0.006)	0.153*** (0.037)	0.063*** (0.006)	0.101*** (0.035)
Affectionate attitudes towards disabilities	1.179*** (0.069)	8.276*** (0.627)	1.571*** (0.076)	7.676*** (0.599)
Constant	-8.028*** (0.533)	-6.453* (3.739)	-4.673*** (0.541)	-6.970** (3.463)
Observations	15841	2396	15842	2396
Adjusted R^2	0.507	0.479	0.512	0.467
Bic	79220.097	16225.634	81550.921	16061.559
Aic	79043.679	16104.221	81374.501	15940.146

* p<0.1, ** p<0.05, *** p<0.01

Table A2. Oaxaca Decomposition for Literacy and Numeracy Scores at Primary Schools/Madrasahs (AN 2023)

	Literacy		Numeracy	
	SD	MI	SD	MI
Overall				
Private schools/madrasahs	5.458*** (0.087)	5.469*** (0.209)	3.617*** (0.091)	0.392** (0.200)
Public schools/madrasahs	3.462*** (0.035)	5.121*** (0.575)	1.878*** (0.039)	0.209 (0.545)
Difference	1.996*** (0.094)	0.348 (0.612)	1.739*** (0.099)	0.182 (0.581)
Explained	0.494*** (0.077)	0.079 (0.459)	0.389*** (0.082)	0.057 (0.435)
Unexplained	1.502*** (0.074)	0.269 (0.433)	1.350*** (0.077)	0.125 (0.426)
Explained				
Accredited C	-0.022*** (0.007)	-0.017 (0.035)	-0.015*** (0.006)	-0.007 (0.017)
Accredited B	-0.092*** (0.028)	-0.374 (0.358)	-0.103*** (0.027)	-0.039 (0.329)
Accredited A	0.196*** (0.025)	-0.029 (0.361)	0.176*** (0.024)	-0.138 (0.339)
Library (=1)	0.005* (0.003)	-0.029 (0.028)	0.001 (0.003)	-0.048 (0.044)
Internet access	0.040*** (0.007)	-0.000 (0.010)	0.032*** (0.006)	0.001 (0.010)
Merdeka curriculum	-0.004 (0.003)	-0.066 (0.042)	-0.003 (0.002)	-0.062 (0.040)
Principal gender (Female=1)	0.002 (0.002)	-0.000 (0.014)	0.001 (0.001)	-0.000 (0.007)
Parents' participation	0.059*** (0.011)	0.209** (0.083)	0.046*** (0.009)	0.180** (0.072)
Students-school SES	0.085*** (0.012)	-0.041 (0.029)	0.062*** (0.010)	-0.037 (0.027)
Female teacher ratio	0.035*** (0.007)	-0.049 (0.031)	0.015** (0.006)	-0.030 (0.023)
Bachelor's degree teacher ratio	-0.058*** (0.015)	-0.020 (0.021)	-0.072*** (0.015)	-0.019 (0.019)
Age 40+ teacher ratio	0.204*** (0.021)	0.308** (0.124)	0.184*** (0.021)	0.383*** (0.122)
Certified teacher ratio	-0.433*** (0.031)	0.003 (0.056)	-0.357*** (0.031)	-0.070 (0.055)
Training via PMM	-0.015 (0.010)		-0.003 (0.010)	
Training NOT via PMM	0.005 (0.005)		0.004 (0.004)	
Classroom management and positive discipline	0.037** (0.016)	-0.128* (0.076)	0.046** (0.020)	-0.145* (0.085)
Teachers' innovative practices	0.313*** (0.027)	0.769*** (0.149)	0.220*** (0.021)	0.558*** (0.119)
No bullying	0.016 (0.025)	-0.255* (0.149)	0.017 (0.028)	-0.258* (0.151)
Gender equality behaviour	0.002 (0.006)	0.035 (0.033)	0.002 (0.005)	0.030 (0.029)
Disability services	0.028** (0.014)	0.088* (0.052)	0.018** (0.009)	0.058 (0.037)

	Literacy		Numeracy	
	SD	MI	SD	MI
Affectionate attitudes towards disabilities	0.090*** (0.016)	-0.324* (0.191)	0.119*** (0.021)	-0.300* (0.177)
Unexplained				
Accredited C	0.033 (0.031)	0.167 (0.198)	0.020 (0.029)	0.132 (0.200)
Accredited B	0.184 (0.140)	2.637 (2.125)	0.105 (0.132)	1.612 (2.325)
Accredited A	0.221 (0.156)	3.099 (2.854)	0.210 (0.149)	1.984 (3.078)
Library (=1)	0.463*** (0.179)	0.209 (0.684)	0.539*** (0.187)	0.965 (0.729)
Internet access	0.725*** (0.280)	-0.645 (2.383)	0.533** (0.254)	-0.854 (1.849)
Merdeka curriculum	0.052 (0.051)	0.037 (0.330)	0.019 (0.054)	0.072 (0.333)
Principal gender (Female=1)	-0.072 (0.066)	0.124 (0.306)	-0.011 (0.070)	-0.096 (0.310)
Parents' participation	-0.102 (0.493)	1.481 (2.247)	-0.673 (0.495)	-2.534 (2.255)
Students-school SES	-0.584*** (0.205)	4.560*** (1.660)	-0.205 (0.216)	2.222 (1.590)
Female teacher ratio	-0.103 (0.191)	0.556 (0.856)	-0.213 (0.186)	1.087 (0.882)
Bachelor's degree teacher ratio	-0.708 (0.560)	0.740 (3.507)	-0.340 (0.568)	-1.292 (3.567)
Age 40+ teacher ratio	-0.000 (0.010)	-1.951 (1.297)	-0.001 (0.009)	-0.736 (1.263)
Certified teacher ratio	0.125* (0.064)	-0.267** (0.136)	0.146** (0.064)	-0.301** (0.139)
Training via PMM	0.611*** (0.189)		0.513** (0.200)	
Training NOT via PMM	-0.026 (0.056)		-0.173*** (0.061)	
Classroom management and positive discipline	0.361** (0.180)	1.940* (1.071)	0.399** (0.182)	0.856 (1.077)
Teachers' innovative practices	1.027*** (0.255)	-4.906*** (1.902)	1.179*** (0.262)	-5.090*** (1.938)
No bullying	0.026 (0.022)	-0.025 (0.067)	-0.019 (0.022)	-0.006 (0.062)
Gender equality behaviour	-0.179 (0.199)	-2.032 (1.493)	0.006 (0.191)	-1.014 (1.476)
Disability services	4.285*** (1.029)	-0.954 (6.902)	6.115*** (1.029)	3.642 (7.166)
Affectionate attitudes towards disabilities	-0.424 (0.341)	-3.211 (2.422)	-0.576 (0.359)	-1.750 (2.349)
Constant	-4.412*** (1.344)	-1.289 (9.863)	-6.224*** (1.334)	1.225 (10.175)
Observations	15841	2396	15842	2396

* p<0.1, ** p<0.05, *** p<0.01

Table A3. Literacy and Numeracy Scores in Junior Secondary Schools (AN 2023)

	Literacy		Numeracy	
	SMP	MTs	SMP	MTs
School status	-1.765*** (0.086)	0.243 (0.298)	-1.419*** (0.085)	0.401 (0.300)
Accredited C	-0.920*** (0.186)	-1.864* (1.034)	-0.528*** (0.183)	-1.303 (1.218)
Accredited B	0.359** (0.166)	-0.069 (0.991)	0.376** (0.164)	0.117 (1.180)
Accredited A	1.915*** (0.169)	2.268** (0.999)	1.751*** (0.168)	1.907 (1.191)
Library (=1)	0.817*** (0.136)	1.289*** (0.280)	0.582*** (0.136)	1.386*** (0.274)
Internet access	1.096*** (0.111)	0.517 (0.464)	0.927*** (0.112)	0.277 (0.480)
Merdeka curriculum	0.215*** (0.071)	1.129*** (0.220)	0.146** (0.072)	1.310*** (0.217)
Principal gender (Female=1)	-0.048 (0.070)	-0.464** (0.234)	0.020 (0.071)	-0.514** (0.236)
Parents' participation	0.553*** (0.162)	0.411 (0.425)	0.585*** (0.158)	0.836* (0.429)
Students-school SES	0.577*** (0.120)	0.047 (0.479)	0.628*** (0.121)	0.110 (0.461)
Female teacher ratio	0.169*** (0.051)	-0.060 (0.171)	0.160*** (0.051)	0.041 (0.159)
Bachelor's degree teacher ratio	-0.022 (0.139)	-0.530* (0.300)	0.178 (0.153)	-0.259 (0.296)
Age 40+ teacher ratio	-0.162*** (0.057)	-0.729*** (0.158)	-0.087 (0.060)	-0.614*** (0.147)
Certified teacher ratio	0.520*** (0.064)	0.255** (0.130)	0.541*** (0.066)	0.458*** (0.125)
Training via PMM	0.083*** (0.029)		0.018 (0.030)	
Training NOT via PMM	-0.169*** (0.039)		-0.238*** (0.039)	
Teachers' innovative practices	-1.633*** (0.105)	-2.608*** (0.353)	-0.979*** (0.105)	-2.602*** (0.356)
Vision & mission for learning	0.215*** (0.066)	0.645*** (0.234)	0.112* (0.066)	0.829*** (0.228)
No bullying	-0.253*** (0.068)	-0.158 (0.240)	-0.097 (0.068)	0.111 (0.231)
No physical discipline	1.382*** (0.054)	2.924*** (0.175)	1.186*** (0.054)	2.490*** (0.177)
Gender equality behaviour	0.693*** (0.106)	0.128 (0.229)	0.680*** (0.109)	0.125 (0.213)
Disability services	0.139*** (0.009)	0.187*** (0.025)	0.117*** (0.009)	0.169*** (0.025)
Affectionate attitudes towards disabilities	2.134*** (0.096)	7.027*** (0.438)	2.221*** (0.098)	6.990*** (0.441)
Constant	-7.971*** (0.915)	-0.356 (2.477)	-6.759*** (0.934)	-2.546 (2.572)
Observations	10732	3400	10733	3401
Adjusted R2	0.547	0.518	0.528	0.498
bic	57093.241	21875.085	57302.571	21767.073
aic	56918.497	21740.192	57127.825	21632.172

* p<0.1, ** p<0.05, *** p<0.01

Table A4. Oaxaca Decomposition for Literacy and Numeracy Scores at Junior Secondary Schools/ Madrasahs (AN 2023)

	Literacy		Numeracy	
	SMP	MTs	SMP	MTs
Overall				
Private schools/madrasahs	3.150*** (0.080)	2.332*** (0.153)	2.225*** (0.080)	0.289** (0.147)
Public schools/madrasahs	2.514*** (0.062)	7.453*** (0.388)	2.018*** (0.061)	5.266*** (0.400)
Difference	0.636*** (0.101)	-5.121*** (0.418)	0.207** (0.100)	-4.977*** (0.426)
Explained	-1.129*** (0.089)	-4.879*** (0.349)	-1.212*** (0.087)	-4.576*** (0.336)
Unexplained	1.765*** (0.085)	-0.243 (0.298)	1.419*** (0.084)	-0.401 (0.298)
Explained				
Accredited C	0.005 (0.007)	-0.255* (0.142)	0.003 (0.004)	-0.179 (0.167)
Accredited B	0.029** (0.014)	-0.026 (0.372)	0.031** (0.014)	0.044 (0.443)
Accredited A	-0.183*** (0.024)	-1.174** (0.519)	-0.167*** (0.023)	-0.987 (0.617)
Library (=1)	-0.072*** (0.013)	-0.226*** (0.053)	-0.052*** (0.013)	-0.243*** (0.052)
Internet access	0.113*** (0.014)	-0.005 (0.007)	0.096*** (0.013)	-0.003 (0.006)
Merdeka curriculum	-0.007** (0.003)	-0.181*** (0.046)	-0.005* (0.003)	-0.210*** (0.049)
Principal gender (Female=1)	-0.002 (0.003)	-0.016 (0.013)	0.001 (0.003)	-0.017 (0.014)
Parents' participation	0.034*** (0.011)	-0.012 (0.014)	0.036*** (0.010)	-0.025 (0.018)
Students-school SES	0.057*** (0.012)	-0.001 (0.012)	0.063*** (0.013)	-0.003 (0.012)
Female teacher ratio	-0.024*** (0.008)	0.014 (0.039)	-0.022*** (0.008)	-0.009 (0.037)
Bachelor's degree teacher ratio	0.003 (0.019)	-0.012 (0.012)	-0.024 (0.021)	-0.006 (0.008)
Age 40+ teacher ratio	0.093*** (0.033)	0.293*** (0.069)	0.050 (0.035)	0.247*** (0.063)
Certified teacher ratio	-0.409*** (0.051)	-0.136* (0.070)	-0.425*** (0.053)	-0.245*** (0.071)
Training via PMM	-0.037*** (0.013)		-0.008 (0.013)	
Training NOT via PMM	-0.048*** (0.012)		-0.068*** (0.012)	
Teachers' innovative practices	0.245*** (0.026)	0.594*** (0.095)	0.146*** (0.020)	0.593*** (0.095)
Vision and mission for learning	-0.026*** (0.009)	-0.163*** (0.061)	-0.014* (0.008)	-0.209*** (0.061)
No bullying	0.042*** (0.013)	0.034 (0.052)	0.016 (0.012)	-0.024 (0.050)
No physical discipline	-0.417*** (0.038)	-1.817*** (0.183)	-0.358*** (0.033)	-1.546*** (0.167)
Gender equality behaviour	-0.122*** (0.020)	-0.018 (0.032)	-0.120*** (0.020)	-0.017 (0.030)

	Literacy		Numeracy	
	SMP	MTs	SMP	MTs
Disability services	-0.141*** (0.018)	-0.273*** (0.066)	-0.119*** (0.016)	-0.246*** (0.061)
Affectionate attitudes towards disabilities	-0.261*** (0.030)	-1.499*** (0.177)	-0.272*** (0.031)	-1.489*** (0.177)
Unexplained				
Accredited C	-0.070 (0.067)	0.134* (0.079)	-0.145** (0.066)	0.157* (0.084)
Accredited B	0.048 (0.138)	1.611*** (0.527)	-0.083 (0.137)	1.932*** (0.577)
Accredited A	0.224** (0.111)	3.614*** (1.379)	0.176 (0.111)	4.143*** (1.500)
Library (=1)	0.403* (0.244)	0.339 (1.032)	0.119 (0.245)	0.360 (0.873)
Internet access	0.451** (0.220)	0.063 (1.074)	0.218 (0.223)	-0.361 (1.013)
Merdeka curriculum	0.090** (0.042)	0.330 (0.211)	0.109** (0.043)	0.425** (0.205)
Principal gender (Female=1)	0.001 (0.049)	-0.328** (0.160)	0.034 (0.050)	-0.508*** (0.155)
Parents' participation	1.230** (0.608)	-0.250 (2.435)	1.512** (0.598)	-1.121 (2.172)
Students-school SES	0.121 (0.267)	1.371 (1.361)	0.042 (0.272)	1.480 (1.275)
Female teacher ratio	-0.391*** (0.142)	0.375 (0.736)	-0.265* (0.146)	-0.461 (0.668)
Bachelor's degree teacher ratio	-0.899 (1.124)	1.388 (2.467)	-1.183 (1.185)	3.702* (2.248)
Age 40+ teacher ratio	-0.210*** (0.044)	-1.529 (0.997)	-0.193*** (0.046)	-2.772*** (0.895)
Certified teacher ratio	0.123*** (0.019)	0.014 (0.149)	0.081*** (0.017)	0.080 (0.141)
Training via PMM	0.329 (0.202)		-0.105 (0.206)	
Training NOT via PMM	-0.011 (0.040)		-0.105*** (0.039)	
Teachers' innovative practices	-0.037 (0.368)	-1.093 (1.949)	0.256 (0.371)	-1.739 (1.603)
Vision and mission for learning	-0.152 (0.318)	-0.494 (1.470)	0.143 (0.325)	-0.850 (1.346)
No bullying	-0.325*** (0.110)	-0.813** (0.355)	-0.244** (0.109)	-0.847** (0.359)
No physical discipline	0.020** (0.008)	-0.357* (0.198)	0.026*** (0.008)	-0.734*** (0.201)
Gender equality behaviour	-0.161 (0.111)	-0.398 (0.637)	-0.015 (0.116)	-0.172 (0.601)
Disability services	0.309 (1.198)	0.471 (4.755)	2.157* (1.215)	3.781 (4.490)
Affectionate attitudes towards disabilities	-0.750** (0.379)	0.607 (1.693)	-0.602 (0.387)	0.916 (1.694)
Constant	1.424 (1.963)	-5.298 (6.373)	-0.517 (2.012)	-7.813 (6.294)
Observations	10732	3400	10733	3401

* p<0.1, ** p<0.05, *** p<0.01

Table A5. Creative Thinking and Critical Reasoning Scores in Primary Schools/Madrasahs (AN 2023)

	Creative thinking		Critical reasoning	
	SD	MI	SD	MI
School status (Public==1)	0.144*** (0.016)	-0.010 (0.067)	0.045*** (0.014)	0.043 (0.057)
Accredited C	0.085** (0.035)	0.136 (0.251)	0.033 (0.032)	0.251 (0.192)
Accredited B	0.059** (0.027)	0.100 (0.234)	-0.006 (0.025)	0.195 (0.177)
Accredited A	0.018 (0.028)	0.146 (0.235)	-0.058** (0.026)	0.233 (0.178)
Library (=1)	-0.010 (0.015)	0.062 (0.045)	-0.019 (0.013)	0.009 (0.036)
Internet access	-0.008 (0.018)	0.010 (0.087)	-0.041*** (0.016)	0.069 (0.070)
Merdeka curriculum	0.010 (0.011)	0.019 (0.042)	-0.000 (0.010)	0.005 (0.034)
Principal gender (Female=1)	-0.032*** (0.011)	-0.042 (0.042)	-0.038*** (0.010)	0.005 (0.033)
Parents' participation	-0.174*** (0.020)	-0.107 (0.090)	-0.210*** (0.018)	-0.169** (0.074)
Students-school SES	0.022 (0.019)	0.015 (0.106)	-0.041** (0.018)	-0.149* (0.084)
Female teacher ratio	0.009 (0.007)	0.008 (0.038)	-0.007 (0.007)	0.003 (0.030)
Bachelor's degree teacher ratio	-0.017 (0.018)	-0.008 (0.061)	-0.010 (0.016)	-0.019 (0.049)
Age 40+ teacher ratio	-0.008 (0.007)	0.050 (0.033)	0.006 (0.006)	0.064** (0.027)
Certified teacher ratio	0.030*** (0.007)	0.033 (0.026)	-0.005 (0.006)	-0.044** (0.021)
Classroom management and positive discipline	0.156*** (0.016)	0.394*** (0.065)	0.192*** (0.014)	0.436*** (0.053)
Teachers' innovative practices	0.417*** (0.014)	0.464*** (0.080)	0.424*** (0.013)	0.385*** (0.080)
No bullying	0.054*** (0.008)	0.211*** (0.034)	0.040*** (0.007)	0.101*** (0.026)
Gender equality behaviour	-0.055*** (0.016)	-0.076 (0.060)	-0.033** (0.014)	0.039 (0.046)
Disability services	0.001 (0.001)	0.001 (0.005)	-0.006*** (0.001)	-0.003 (0.004)
Affectionate attitudes towards disabilities	0.950*** (0.020)	1.295*** (0.139)	0.834*** (0.019)	1.117*** (0.125)
Constant	3.207*** (0.118)	3.716*** (0.525)	3.405*** (0.107)	2.920*** (0.450)
Observations	15841	2395	15841	2395
Adjusted R2	0.615	0.385	0.615	0.402
bic	33206.693	6731.619	30035.614	5708.132
aic	33045.616	6610.215	29874.536	5586.728

* p<0.1, ** p<0.05, *** p<0.01

Table A6. Oaxaca Decomposition for Creative Thinking and Critical Reasoning Scores at Primary Schools/Madrasahs (AN 2023)

	Creative thinking		Critical reasoning	
	SD	MI	SD	MI
Overall				
Private schools/madrasahs	0.241*** (0.019)	0.611*** (0.026)	-0.070*** (0.017)	-0.029 (0.021)
Public schools/madrasahs	0.421*** (0.010)	0.818*** (0.079)	0.012 (0.009)	0.183*** (0.067)
Difference	-0.180*** (0.021)	-0.206** (0.083)	-0.082*** (0.019)	-0.211*** (0.070)
Explained	-0.036* (0.020)	-0.216*** (0.055)	-0.037** (0.018)	-0.168*** (0.047)
Unexplained	-0.144*** (0.016)	0.010 (0.067)	-0.045*** (0.014)	-0.043 (0.057)
Explained				
Accredited C	0.002** (0.001)	0.001 (0.002)	0.001 (0.001)	0.001 (0.003)
Accredited B	-0.012** (0.006)	0.017 (0.040)	0.001 (0.005)	0.034 (0.031)
Accredited A	0.003 (0.004)	-0.026 (0.041)	-0.009** (0.004)	-0.041 (0.032)
Library (=1)	-0.000 (0.001)	-0.002 (0.002)	-0.001 (0.001)	-0.000 (0.001)
Internet access	-0.000 (0.001)	-0.000 (0.001)	-0.002** (0.001)	-0.001 (0.001)
Merdeka curriculum	-0.000 (0.000)	-0.001 (0.002)	0.000 (0.000)	-0.000 (0.002)
Principal gender (Female=1)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)	0.000 (0.000)
Parents' participation	-0.008*** (0.002)	-0.005 (0.005)	-0.010*** (0.002)	-0.009* (0.005)
Students-school SES	0.002 (0.002)	-0.000 (0.003)	-0.004** (0.002)	0.005 (0.003)
Female teacher ratio	0.002 (0.001)	-0.001 (0.002)	-0.001 (0.001)	-0.000 (0.002)
Bachelor's degree teacher ratio	0.003 (0.003)	0.000 (0.001)	0.002 (0.003)	0.000 (0.001)
Age 40+ teacher ratio	0.005 (0.004)	-0.024 (0.016)	-0.004 (0.004)	-0.030** (0.013)
Certified teacher ratio	-0.027*** (0.007)	-0.009 (0.008)	0.005 (0.006)	0.013* (0.006)
Classroom management and positive discipline	0.005** (0.002)	-0.019* (0.011)	0.006** (0.003)	-0.021* (0.012)
Teachers' innovative practices	-0.081*** (0.007)	-0.077*** (0.019)	-0.082*** (0.007)	-0.064*** (0.017)
No bullying	0.001 (0.001)	-0.018* (0.011)	0.001 (0.001)	-0.009 (0.006)
Gender equality behaviour	-0.000 (0.001)	-0.002 (0.002)	-0.000 (0.000)	0.001 (0.001)
Disability services	0.000 (0.000)	0.001 (0.003)	-0.002* (0.001)	-0.002 (0.002)
Affectionate attitudes towards disabilities	0.072*** (0.013)	-0.051* (0.030)	0.063*** (0.011)	-0.044* (0.026)

	Creative thinking		Critical reasoning	
	SD	MI	SD	MI
Unexplained				
Accredited C	-0.006 (0.006)	-0.001 (0.015)	-0.011** (0.005)	0.003 (0.011)
Accredited B	-0.025 (0.026)	-0.234 (0.178)	-0.020 (0.024)	-0.169 (0.128)
Accredited A	-0.067** (0.030)	-0.298 (0.249)	-0.037 (0.028)	-0.192 (0.179)
Library (=1)	-0.074** (0.036)	0.073 (0.125)	-0.051 (0.032)	0.217** (0.106)
Internet access	-0.021 (0.057)	-0.067 (0.410)	0.001 (0.047)	-0.353 (0.249)
Merdeka curriculum	-0.000 (0.012)	0.173*** (0.053)	-0.004 (0.010)	0.051 (0.041)
Principal gender (Female=1)	0.006 (0.015)	-0.023 (0.047)	0.004 (0.013)	0.049 (0.038)
Parents' participation	0.054 (0.105)	-0.059 (0.302)	0.100 (0.096)	0.064 (0.251)
Students-school SES	-0.109** (0.049)	0.196 (0.234)	-0.010 (0.044)	0.243 (0.184)
Female teacher ratio	-0.004 (0.038)	0.286** (0.140)	-0.034 (0.033)	0.230** (0.115)
Bachelor's degree teacher ratio	-0.120 (0.108)	-1.081* (0.553)	-0.208** (0.096)	-0.857* (0.447)
Age 40+ teacher ratio	-0.002 (0.002)	0.009 (0.179)	-0.000 (0.002)	0.210 (0.160)
Certified teacher ratio	-0.020 (0.014)	0.008 (0.020)	-0.015 (0.012)	-0.012 (0.017)
Classroom management and positive discipline	-0.093** (0.039)	0.351** (0.152)	-0.049 (0.034)	0.304** (0.131)
Teachers' innovative practices	0.213*** (0.066)	-0.351 (0.325)	0.177*** (0.060)	-0.060 (0.313)
No bullying	0.008* (0.005)	-0.001 (0.010)	0.011*** (0.004)	-0.001 (0.008)
Gender equality behaviour	-0.028 (0.036)	-0.257 (0.207)	-0.037 (0.031)	-0.339** (0.154)
Disability services	-0.330 (0.227)	-0.751 (0.994)	-0.002 (0.192)	0.685 (0.811)
Affectionate attitudes towards disabilities	0.420*** (0.096)	-0.003 (0.557)	0.443*** (0.084)	0.207 (0.548)
Constant	0.052 (0.302)	2.039 (1.403)	-0.304 (0.273)	-0.323 (1.193)
Observations	15841	2395	15841	2395

* p<0.1, ** p<0.05, *** p<0.01

Table A7. Creative Thinking and Critical Reasoning Scores in Junior Secondary Schools/Madrasahs (AN 2023)

	Creative thinking		Critical reasoning	
	SMP	MTs	SMP	MTs
School status (Public=1)	0.031* (0.016)	-0.098* (0.051)	-0.078*** (0.013)	-0.049 (0.037)
Accredited C	0.056* (0.034)	-0.169 (0.168)	0.001 (0.028)	0.033 (0.129)
Accredited B	0.019 (0.030)	-0.122 (0.162)	-0.008 (0.024)	0.045 (0.124)
Accredited A	-0.020 (0.031)	-0.016 (0.164)	0.069*** (0.025)	0.171 (0.127)
Library (=1)	-0.025 (0.025)	0.018 (0.041)	0.014 (0.020)	0.084*** (0.029)
Internet access	-0.010 (0.022)	-0.088 (0.071)	0.013 (0.017)	-0.017 (0.050)
Merdeka curriculum	-0.000 (0.014)	0.030 (0.035)	0.020* (0.012)	0.055** (0.026)
Principal gender (Female=1)	-0.016 (0.014)	0.022 (0.036)	-0.013 (0.011)	-0.048* (0.027)
Parents' participation	-0.095*** (0.030)	-0.113* (0.064)	-0.031 (0.024)	-0.039 (0.056)
Students-school SES	0.011 (0.023)	0.093 (0.070)	0.024 (0.018)	0.001 (0.050)
Female teacher ratio	-0.001 (0.010)	0.003 (0.024)	-0.006 (0.008)	-0.016 (0.018)
Bachelor's degree teacher ratio	-0.028 (0.025)	0.103** (0.043)	0.008 (0.020)	0.016 (0.038)
Age 40+ teacher ratio	-0.006 (0.012)	-0.049** (0.024)	-0.021** (0.009)	-0.055*** (0.018)
Certified teacher ratio	0.008 (0.013)	-0.003 (0.020)	0.024** (0.010)	0.009 (0.015)
Teachers' innovative practices	0.330*** (0.021)	0.361*** (0.059)	0.132*** (0.018)	0.146*** (0.048)
Vision and mission for learning	0.008 (0.013)	0.097*** (0.036)	0.007 (0.010)	0.066** (0.027)
No bullying	0.112*** (0.013)	0.058 (0.036)	0.054*** (0.011)	0.042 (0.028)
No physical discipline	-0.120*** (0.010)	-0.046* (0.027)	-0.016** (0.008)	0.058*** (0.022)
Gender equality behaviour	0.002 (0.020)	0.005 (0.034)	0.068*** (0.017)	0.026 (0.030)
Disability services	-0.002 (0.002)	-0.008** (0.004)	0.005*** (0.002)	0.002 (0.003)
Affectionate attitudes towards disabilities	1.332*** (0.024)	2.136*** (0.103)	1.110*** (0.022)	1.626*** (0.087)
Constant	3.556*** (0.175)	4.526*** (0.437)	2.095*** (0.145)	2.864*** (0.361)
Observations	10732	3400	10732	3400
Adjusted R2	0.671	0.482	0.702	0.540
BIC	22561.767	9123.510	17639.530	7163.141
AIC	22401.586	8988.616	17479.348	7028.247

Table A8. Oaxaca Decomposition for Creative Thinking and Critical Reasoning Scores at Junior Secondary Schools/Madrasahs (AN 2023)

	Creative thinking		Critical reasoning	
	SMP	MTs	SMP	MTs
Overall				
Private schools/madrasahs	-0.180*** (0.017)	-0.313*** (0.023)	-0.067*** (0.015)	-0.054*** (0.018)
Public schools/madrasahs	0.045*** (0.015)	0.167** (0.066)	0.046*** (0.013)	0.415*** (0.054)
Difference	-0.224*** (0.023)	-0.480*** (0.070)	-0.114*** (0.019)	-0.469*** (0.057)
Explained	-0.194*** (0.021)	-0.579*** (0.056)	-0.191*** (0.018)	-0.518*** (0.046)
Unexplained	-0.031* (0.016)	0.098* (0.051)	0.078*** (0.013)	0.049 (0.038)
Explained				
Accredited C	-0.000 (0.000)	-0.023 (0.023)	-0.000 (0.000)	0.005 (0.018)
Accredited B	0.002 (0.002)	-0.046 (0.061)	-0.001 (0.002)	0.017 (0.046)
Accredited A	0.002 (0.003)	0.008 (0.085)	-0.007*** (0.002)	-0.089 (0.066)
Library (=1)	0.002 (0.002)	-0.003 (0.007)	-0.001 (0.002)	-0.015*** (0.005)
Internet access	-0.001 (0.002)	0.001 (0.001)	0.001 (0.002)	0.000 (0.001)
Merdeka curriculum	0.000 (0.000)	-0.005 (0.006)	-0.001 (0.000)	-0.009** (0.004)
Principal gender (Female=1)	-0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.002 (0.001)
Parents' participation	-0.006*** (0.002)	0.003 (0.003)	-0.002 (0.001)	0.001 (0.002)
Students-school SES	0.001 (0.002)	-0.002 (0.002)	0.002 (0.002)	-0.000 (0.001)
Female teacher ratio	0.000 (0.001)	-0.001 (0.006)	0.001 (0.001)	0.004 (0.004)
Bachelor's degree teacher ratio	0.004 (0.003)	0.002 (0.002)	-0.001 (0.003)	0.000 (0.001)
Age 40+teacher ratio	0.004 (0.007)	0.020** (0.010)	0.012** (0.005)	0.022*** (0.008)
Certified teacher ratio	-0.006 (0.010)	0.001 (0.010)	-0.019** (0.008)	-0.005 (0.008)
Teachers' innovative practices	-0.049*** (0.005)	-0.082*** (0.015)	-0.020*** (0.003)	-0.033*** (0.011)
Vision and mission for learning	-0.001 (0.002)	-0.025*** (0.009)	-0.001 (0.001)	-0.017** (0.007)
No bullying	-0.019*** (0.003)	-0.013 (0.008)	-0.009*** (0.002)	-0.009 (0.006)
No physical discipline	0.036*** (0.004)	0.028* (0.017)	0.005* (0.003)	-0.036*** (0.014)
Gender equality behaviour	-0.000 (0.004)	-0.001 (0.005)	-0.012*** (0.003)	-0.004 (0.004)
Disability services	0.002 (0.002)	0.012** (0.006)	-0.005*** (0.002)	-0.003 (0.005)

	Creative thinking		Critical reasoning	
	SMP	MTs	SMP	MTs
Affectionate attitudes towards disabilities	-0.163*** (0.017)	-0.456*** (0.051)	-0.136*** (0.014)	-0.347*** (0.039)
Unexplained				
Accredited C	0.008 (0.013)	0.006 (0.011)	0.011 (0.010)	0.011 (0.008)
Accredited B	-0.007 (0.025)	0.065 (0.086)	0.024 (0.020)	0.105* (0.059)
Accredited A	-0.012 (0.021)	0.277 (0.237)	0.030* (0.017)	0.342** (0.151)
Library (=1)	-0.036 (0.047)	0.090 (0.152)	-0.044 (0.038)	0.078 (0.097)
Internet access	0.054 (0.042)	-0.046 (0.127)	0.025 (0.033)	-0.005 (0.095)
Merdeka curriculum	0.012 (0.009)	0.041 (0.035)	0.012* (0.007)	0.031 (0.025)
Principal gender (Female=1)	-0.021** (0.010)	0.019 (0.026)	-0.006 (0.008)	-0.007 (0.019)
Parents' participation	0.101 (0.117)	0.629* (0.362)	0.103 (0.092)	0.793*** (0.262)
Students-school SES	-0.026 (0.053)	0.103 (0.190)	0.010 (0.042)	0.037 (0.134)
Female teacher ratio	-0.059** (0.029)	0.016 (0.111)	-0.031 (0.022)	-0.013 (0.077)
Bachelor's degree teacher ratio	0.015 (0.202)	0.416 (0.386)	0.062 (0.162)	-0.045 (0.292)
Age 40+ teacher ratio	-0.011 (0.009)	-0.171 (0.158)	-0.008 (0.007)	-0.087 (0.119)
Certified teacher ratio	0.005* (0.003)	-0.021 (0.024)	0.004** (0.002)	-0.018 (0.018)
Teachers' innovative practices	0.147** (0.074)	0.586* (0.304)	0.077 (0.062)	0.385* (0.224)
Vision and mission for learning	0.039 (0.065)	-0.052 (0.240)	0.040 (0.051)	0.021 (0.167)
No bullying	-0.003 (0.021)	0.058 (0.060)	-0.006 (0.018)	0.025 (0.046)
No physical discipline	-0.002 (0.002)	0.062** (0.031)	-0.002* (0.001)	-0.005 (0.023)
Gender equality behaviour	-0.036 (0.022)	0.132 (0.101)	-0.030* (0.018)	0.074 (0.071)
Disability services	-0.066 (0.249)	-0.050 (0.762)	-0.042 (0.202)	-0.383 (0.526)
Affectionate attitudes towards disabilities	0.119 (0.093)	0.736** (0.318)	0.107 (0.086)	0.564** (0.254)
Constant	-0.251 (0.381)	-2.799** (1.120)	-0.256 (0.308)	-1.854** (0.784)
Observations	10732	3400	10732	3400

Table A9. Literacy and Numeracy Scores in MI and MTs (AKMI 2023)

	MI		MTs	
	Literacy	Numeracy	Literacy	Numeracy
Student gender (Female=1)	0.733*** (0.017)	0.205*** (0.008)	0.945*** (0.045)	0.166*** (0.02)
Father's educational background (Junior secondary school=1)	0.191*** (0.026)	0.069*** (0.012)	0.178*** (0.065)	0.011 (0.029)
Father's educational background (Senior high school=1)	0.362*** (0.027)	0.109*** (0.012)	0.261*** (0.067)	0.051* (0.03)
Father's educational background (University=1)	0.801*** (0.04)	0.248*** (0.019)	0.422*** (0.109)	0.048 (0.048)
Mother's educational background (Junior secondary school=1)	0.250*** (0.026)	0.074*** (0.012)	0.086 (0.064)	0 (0.029)
Mother's educational background (Senior high school=1)	0.515*** (0.027)	0.130*** (0.013)	0.434*** (0.067)	0.041 (0.03)
Mother's educational background (University=1)	0.925*** (0.038)	0.257*** (0.018)	0.654*** (0.103)	0.137*** (0.045)
Father’s age	0.001 (0.001)	0 (0)	0.010*** (0.003)	0.002 (0.002)
Mother’s age	0.001 (0.001)	0 (0)	0.004 (0.004)	0 (0.002)
Family income (<Rp 500,000=1)	-0.632*** (0.037)	-0.138*** (0.017)	-0.307** (0.151)	-0.118* (0.069)
Family income (Rp 500,000 = Rp 1,000,000 =1)	-0.439*** (0.035)	-0.092*** (0.016)	0.076 (0.149)	-0.063 (0.068)
Family income (<Rp 1,000,001 - Rp 2,000,000=1)	-0.242*** (0.036)	-0.019 (0.016)	0.365** (0.149)	-0.01 (0.068)
Family income (<Rp2,000,001 - Rp3,000,000 =1)	-0.112*** (0.039)	0.021 (0.018)	0.388*** (0.15)	-0.028 (0.069)
Family income (<Rp3,000,001 - Rp5,000,000=1)	0.202*** (0.046)	0.129*** (0.021)	0.593*** (0.164)	0.094 (0.074)
Family income (> Rp 5,000,0000=1)	0.532*** (0.072)	0.234*** (0.035)	0.876*** (0.196)	0.044 (0.093)
School geography (mountainous =1)	-0.013 (0.019)	-0.006 (0.009)	-0.090* (0.05)	-0.014 (0.023)
School geography (coastal =1)	-0.02 (0.033)	0.015 (0.016)	-0.003 (0.087)	0.097** (0.038)
School status (public =1)	0.043 (0.041)	0.007 (0.019)	0.031 (0.106)	-0.004 (0.047)
Constant	-3.034*** (0.052)	-0.245*** (0.024)	5.147*** (0.198)	-0.167* (0.092)
Observations	59830	59830	9690	9690

* p<0.1, ** p<0.05, *** p<0.01

Table A10. Oaxaca Decomposition for Literacy and Numeracy Scores in MI and MTs (AKMI 2023)

	MI		MTs	
	Literacy	Numeracy	Literacy	Numeracy
Overall				
Group_1	-2.592*** (0.013)	-0.099*** (0.006)	6.333*** (0.032)	-0.083*** (0.014)
Group_2	-1.858*** (0.013)	0.106*** (0.006)	7.267*** (0.034)	0.082*** (0.014)
Difference	-0.734*** (0.018)	-0.205*** (0.008)	-0.934*** (0.046)	-0.165*** (0.02)
Explained	-0.001 (0.005)	0 (0.002)	0.011 (0.011)	0.001 (0.002)
Unexplained	-0.733*** (0.017)	-0.205*** (0.008)	-0.945*** (0.045)	-0.166*** (0.02)
Explained				
Father's educational background (Junior secondary school=1)	0 (0.001)	0 (0)	0.001 (0.002)	0 (0)
Father's educational background (Senior high school=1)	0.001 (0.001)	0 (0)	-0.001 (0.003)	0 (0.001)
Father's educational background (University=1)	0.001 (0.002)	0 (0.001)	0.005* (0.003)	0.001 (0.001)
Mother's educational background (Junior secondary school=1)	0.001 (0.001)	0 (0)	0 (0.001)	0 (0)
Mother's educational background (Senior high school=1)	0.001 (0.002)	0 (0.001)	-0.004 (0.004)	0 (0)
Mother's educational background (University=1)	-0.003 (0.003)	-0.001 (0.001)	0.006 (0.004)	0.001 (0.001)
Father's age	0 (0)	0 (0)	0.001 (0.002)	0 (0)
Mother's age	0 (0)	0 (0)	0 (0.001)	0 (0)
Family income (<Rp 500,000=1)	0.001 (0.002)	0 (0)	0.003 (0.003)	0.001 (0.001)
Family income (Rp 500,000 = Rp 1,000,000 =1)	-0.002 (0.002)	-0.001 (0)	0 (0.001)	0 (0.001)
Family income (<Rp 1,000,001 - Rp 2,000,000=1)	0.001 (0.001)	0 (0)	-0.001 (0.003)	0 (0)
Family income (<Rp2,000,001 - Rp3,000,000 =1)	0 (0)	0 (0)	0.001 (0.003)	0 (0)
Family income (<Rp3,000,001 - Rp5,000,000=1)	0.001 (0)	0 (0)	0.004 (0.003)	0.001 (0.001)
Family income (> Rp 5,000,0000=1)	-0.001* (0.001)	-0.000* (0)	-0.002 (0.003)	0 (0)
School geography (mountainous =1)	0 (0)	0 (0)	-0.001 (0.001)	0 (0)
School geography (coastal =1)	0 (0)	0 (0)	0 (0.001)	-0.001* (0.001)
School status (public =1)	0 (0)	0 (0)	0 (0.001)	0 (0)
Unexplained				
Father's educational background (Junior secondary school=1)	0.005 (0.012)	0 (0.006)	-0.053* (0.029)	-0.02 (0.013)
Father's educational background (Senior high school=1)	0.027 (0.02)	0.01 (0.009)	0.019 (0.047)	0.011 (0.021)

	MI		MTs	
	Literacy	Numeracy	Literacy	Numeracy
Father's educational background (University=1)	0.018* (0.009)	0.007 (0.004)	0.002 (0.02)	-0.011 (0.009)
Mother's educational background (Junior secondary school=1)	-0.006 (0.013)	-0.002 (0.006)	-0.02 (0.032)	-0.007 (0.014)
Mother's educational background (Senior high school=1)	-0.028 (0.018)	-0.011 (0.009)	-0.056 (0.042)	-0.002 (0.019)
Mother's educational background (University=1)	-0.008 (0.01)	-0.001 (0.005)	-0.013 (0.022)	-0.007 (0.01)
Father’s age	-0.015 (0.084)	0.021 (0.037)	-0.275 (0.309)	-0.064 (0.147)
Mother’s age	0.045 (0.081)	0.03 (0.037)	0.271 (0.323)	0.045 (0.147)
Family income (<Rp 500,000=1)	0.011 (0.015)	-0.008 (0.007)	0.037 (0.053)	-0.008 (0.024)
Family income (Rp 500,000 = Rp 1,000,000 =1)	-0.011 (0.019)	-0.018** (0.009)	0.084 (0.079)	-0.011 (0.036)
Family income (<Rp 1,000,001 - Rp 2,000,000=1)	-0.008 (0.017)	-0.007 (0.008)	0.068 (0.071)	0.006 (0.032)
Family income (<Rp2,000,001 - Rp3,000,000 =1)	0.001 (0.01)	-0.004 (0.005)	0.042 (0.057)	0 (0.026)
Family income (<Rp3,000,001 - Rp5,000,000=1)	-0.006 (0.006)	-0.004 (0.003)	0.011 (0.027)	-0.005 (0.012)
Family income (> Rp 5,000,0000=1)	0 (0.002)	-0.001 (0.001)	0.011 (0.011)	0.004 (0.005)
School geography (mountainous =1)	-0.022* (0.012)	0 (0.005)	0.002 (0.031)	0 (0.014)
School geography (coastal =1)	-0.002 (0.005)	0 (0.002)	-0.007 (0.013)	-0.006 (0.006)
School status (public =1)	0.005 (0.004)	0 -0.002	-0.020** (0.009)	-0.010** (0.004)
Observations	59830	59830	9690	9690

* p<0.1, ** p<0.05, *** p<0.01

United Nations Children's Fund
Email: jakarta@unicef.org
Website: www.unicef.or.id

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