

# The Relative Influence of Age, Gender, Regional Differences and Their Relationship with Students' Numeracy Levels on Madrasah Competency Assessment in Indonesia

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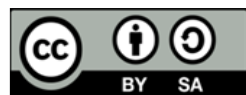
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## ABSTRAK

Tingkat numerasi siswa di Indonesia merupakan aspek kritis dalam penilaian kompetensi pendidikan, terutama di madrasah yang memiliki kurikulum khas berbasis agama dan sains. Penelitian ini dilatarbelakangi oleh kekhawatiran mengenai disparitas kemampuan numerasi yang mungkin dipengaruhi oleh berbagai faktor demografis seperti usia, jenis kelamin, dan perbedaan wilayah. Penelitian ini bertujuan untuk menganalisis kemampuan berhitung siswa berdasarkan umur (10, 11, dan 12 tahun), umur relatif terhadap jenis kelamin (laki-laki dan perempuan), dan umur relatif terhadap wilayah (3T, kabupaten, dan kota). Metode pengumpulan data penelitian ini menggunakan penelitian deskriptif korelasional digunakan untuk menguji hubungan antara gender, sebaran geografis di Indonesia, dan usia optimal siswa dalam berhitung. Metode analisis data menggunakan metode analisis statistik deskriptif. Subjek dalam penelitian ini terdiri dari 297.257 siswa kelas lima Indonesia berpartisipasi dalam Penilaian Kompetensi Madrasah Indonesia (IMCA). Hasil analisis regresi linier menunjukkan bahwa gender dan status kedaerahan berpengaruh terhadap kemampuan berhitung siswa. Hasil penelitian ini dapat dijadikan dasar bagi guru untuk memberikan bimbingan yang tepat kepada siswa dalam proses pembelajaran sesuai dengan tingkat usianya. Implikasi penelitian ini dapat membantu pembuat kebijakan dan pihak sekolah dalam merancang intervensi yang lebih tepat sasaran untuk meningkatkan kemampuan numerasi siswa.

## ABSTRACT

The numeracy level of students in Indonesia is a critical aspect in assessing educational competence, especially in madrasahs with a distinctive religion- and science-based curriculum. This research was motivated by concerns regarding disparities in numeracy abilities that may be influenced by various demographic factors such as age, gender, and regional differences. This study aims to analyze students' numeracy skills based on age (10, 11, and 12 years), age relative to gender (male and female), and age relative to region (3T, district, and city). This data collection method uses descriptive correlational research to test the relationship between gender, geographical distribution in Indonesia, and the optimal age of students in numeracy. The data analysis method uses descriptive statistical analysis methods. The subjects in this study consisted of 297,257 Indonesian fifth-grade students participating in the Indonesian Madrasah Competency Assessment (IMCA). The results of linear regression analysis show that gender and regional status influence students' numeracy skills. The results of this research can be used as a basis for teachers to provide appropriate guidance to students in the learning process according to their age level. The implications of this research can help policymakers and schools design more targeted interventions to improve students' numeracy skills.

## 1. INTRODUCTION

Age has been one of the variables that has been the focus of most research on numeracy skills (Mahdiansyah & Rahmawati, 2014; Verachtert, Fraine, Onghena, & Ghesquière, 2020; Whitely, Phillimore, & Moorin, 2021). Researchers generally find that older students tend to have better numeracy skills. The low numeracy skills of young students are most likely caused by students' difficulties in understanding

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text or question stem stimuli. Did not find significant differences in the numeracy abilities of students aged 10, 11, and 12 years in class V of Islamic Elementary School (*madrassa*) throughout East Java Province. Inconsistent findings from previous studies signal the need for further investigation and exploration (Kusaeri, Dwisanti, Yanti, & Ridho, 2022; Mahdiansyah & Rahmawati, 2014). School admissions can vary based on age range as they are usually done annually based on the child's age. Most Western countries use a minimum age limit for school entry. In addition, OECD countries (including Indonesia) set an age limit, generally 6 or 7 years, for enrollment at primary school level (Mavilidi et al., 2021; Thoren, Heinig, & Brunner, 2016; Verachtert et al., 2020). In fact, once registered, children will learn and interact in one study group. This condition can impact cognitive, social and emotional skills (Faris & Felmler, 2011b; Verachtert et al., 2020). Those who are older tend to be better able to handle complex tasks, have more energy, coordinate their performance, and be more successful than younger students. Older children have better literacy skills learning outcomes (with a standard deviation of 0.45 to 0.49) at the start of formal schooling (Emas, Duzy, Rauch, & Murcia, 2012). This finding shows that there is heterogeneity between students in one class, especially in the early elementary school classes. This phenomenon is known as the relative age effect (RAE) (Aune, Ingvaldsen, Vestheim, Bjerkeset, & Dalen, 2018; Musch & Grondin, 2010). Many researchers have focused on the role of RAE in student achievement (Black, Devereux, & Salvanes, 2010; Puhani & Weber, 2019; Thoren et al., 2016). They primarily examined the effect of RAE on student achievement if the student was older or younger than the average age of students in a class. The results show a negative correlation between relatively younger students and learning outcomes. In other words, the learning outcomes of older students are better than those of younger students. In math, science, and reading, relatively younger children have lower test scores than older students (Bedard & Dhuey, 2020; Craig, 2021).

Previous research on RAE related to numeracy had limited samples (size and area coverage). Apart from that, other variables related to numeracy skills have not been studied in depth. Therefore, it is important to explore RAE in the context of numeracy by utilizing a large amount of data, including national assessment data such as the Indonesian Madrasah Competency Assessment (IMCA) which is managed by the Ministry of Religion of the Republic of Indonesia. This is because *madrassa* IMCA participating students go through stages with characteristics in each aspect of their development. Individual development factors determine attitudes, thought patterns and behavior in individual and social life. Therefore, it is important to explore students' RAE in relation to numeracy skills based on IMCA results. By involving variables such as regional distribution and gender, it is hoped that more comprehensive results can be obtained regarding the relationship between RAE and numeracy skills. Age differences in relation to topography, gender and other variables can be aspects that teachers throughout Indonesia need to consider when planning the teaching and learning process. So you can design models, methods and approaches that are relevant to students' characteristics and conditions. The combination of these aspects in this research differentiates this research from previous research. Indonesia has a diverse archipelagic and mountainous topography with a large gap between urban and rural areas (Dewi, 2022; wardanan, 2020).

Especially in eastern Indonesia and rural areas (Aune et al., 2018; Dewi, 2022). As an analogy, a World Bank report (2016) highlights that third grade students in western Indonesia (Java and Sumatra) are able to read 26 more words per minute than third grade students in eastern Indonesia (Nusa Tenggara, Maluku and Papua). In addition, students in cities can read 18 more words and faster than students in villages. The gap between regions is expected to have an impact on RAE diversity between regions and numeracy literacy abilities. Additionally, gender is thought to influence RAE variability. Research findings can be a basis for teachers to understand students' thinking patterns and abilities. Therefore, teachers can facilitate better learning for students according to age, region in Indonesia, and gender. The findings of this study have important value for policy makers in the Ministry of Religion, because they provide guidance for policy interventions in each region or madrasah in Indonesia, taking into account local conditions and diversity. The current research aims to analyze the role of age groups and gender of students in various regions in Indonesia on their numeracy skills. The uniqueness of this research is that it examines the relationship between the relative influence of age, gender and region on numeracy skills using a significant number of participants and a national sample.

## 2. METHOD

This research method uses a descriptive correlational study method, aims to describe the RAE of fifth grade students *madrassa* in terms of numeracy skills and measuring the relationship between the optimal age of students (10,11,12) in numeracy skills, region, and gender. Thus, RAE's position regarding the variables above can be described more holistically (Aalst & Tubergen, 2022; White & McBurney,

2021). Learning involving 297,257 fifth grade students of Islamic elementary schools (*madrasa*) known as *Madrasah Ibtida'iyah* (MI) took part in IMCA which was organized by the Indonesian Ministry of Religion in 2022. Participants came from 11,061 madrasas consisting of 706 public and 10,895 private (Ramdhani, 2022; White & McBurney, 2021). The instrument used in IMCA 2022 is a written test in 5 (five) forms, namely multiple choice, complex multiple choice, matching, true-false multiple choice, and short answer questions. The variation of questions becomes an integrative part of the stimulus (in the form of text) which is presented in accordance with the content and numeracy context that characterizes IMCA items. Therefore, the 2022 IMCA results were used as the data source for this research because this data is current, comprehensive, and very interesting for additional research. The instruments used in IMCA have gone through a rigorous development process starting from developing the IMCA framework, creating grids, writing processes, internal reviews by teachers and experts, external reviews by national and international assessment experts recruited by the World Bank, readability tests by students and teachers, and field trials. The framework and grid can be seen in the attachment. Creating a framework to ensure construct validity when compiling grids, conducting internal and external reviews, and testing text readability are steps to ensure the content validity of this instrument.

This descriptive correlational study aims to examine the relative influence of age, gender and regional differences on students' numeracy levels on madrasa competency assessments in Indonesia. The research procedure began with determining a representative sample from the madrasah student population in various regions in Indonesia. The sample was taken in a stratified manner to ensure balanced representation based on age, gender and geographic location (city, rural and disadvantaged areas). Data regarding students' numeracy levels was collected through standard numeracy tests adapted from the national competency assessment. In addition, demographic data such as age, gender and area of residence of students were also collected through questionnaires. Next, descriptive analysis was carried out to describe the distribution of student numeracy data based on age, gender and region categories. Then, correlational analysis was carried out to identify the relationship between demographic variables and students' numeracy levels. The analysis techniques used include Pearson correlation to measure the linear relationship between quantitative variables, as well as multiple regression analysis to evaluate the relative influence of each demographic variable on numeracy levels. The results of this analysis are interpreted to identify significant patterns and their implications for educational policy in madrasas. All research procedures are carried out by observing the principles of research ethics, including obtaining approval from the authorities and maintaining the confidentiality of student data. The results of the field trials showed that of the 2,121 items tested for numeracy, the item discrimination index ranged from 0.05 to 0.936. The difficulty level of the questions increased from -28.785 to 0.074. To ensure the validity of the results, the questions selected for the test are questions that have a discrimination index of 0.2 to 0.4, with a difficulty level of questions ranging from -4 to 4 (Umar et al., 2022). A series of steps through testing construct validity, content validity, field trials, and selecting items with recommended levels of difficulty are expected to provide a valid numeracy instrument for score interpretation. This means that a high numeracy value from the test results reflects an increase in the participant's abilities. Conversely, a low score reflects low ability. This study uses descriptive statistical analysis (minimum-maximum scores, mean, and standard deviation (SD)) which reflects participant characteristics. Further analysis was carried out by applying regression analysis to examine the optimal age range for the level of numeracy skills in class V students *madrasa*. The analysis also involves gender and regional location variables. Data were analyzed using SPSS version 25 software.

### 3. RESULT AND DISCUSSION

#### Result

A description of the characteristics of all variables is presented, including age (10, 11, and 12 years), gender (male and female), and regional status, namely 3T (Outermost, Frontier, and Disadvantaged), district, and city. in Table 1. Apart from displaying the minimum, mean and SD values, Table 1 also presents information on skewness and kurtosis to see the normality of the data as a prerequisite for regression testing. The data shows skewness and kurtosis values ranging from -2.58 to 2.58, which means the IMCA 2022 numeracy score data used is normally distributed. Descriptive statistical results. The variables used are presented in Table 1. Table 1 presents the results of the regression analysis for the variables age, gender and regional status. Table 1 shows that there is no difference in numeracy ability between age groups as indicated by a Sig>Alpha value of 0.121 > 0.005. The average for each age group is different, but the difference is not significant. Meanwhile, gender and regional status variables partially influence numeracy skills, indicated by a Sig<Alpha value of 0.000<0.05. Based on this information, it was further identified which age ranges for male and female students

(gender) and which areas had an optimal impact on numeracy skills. The results of the regression analysis of the variables used are presented in Table 2.

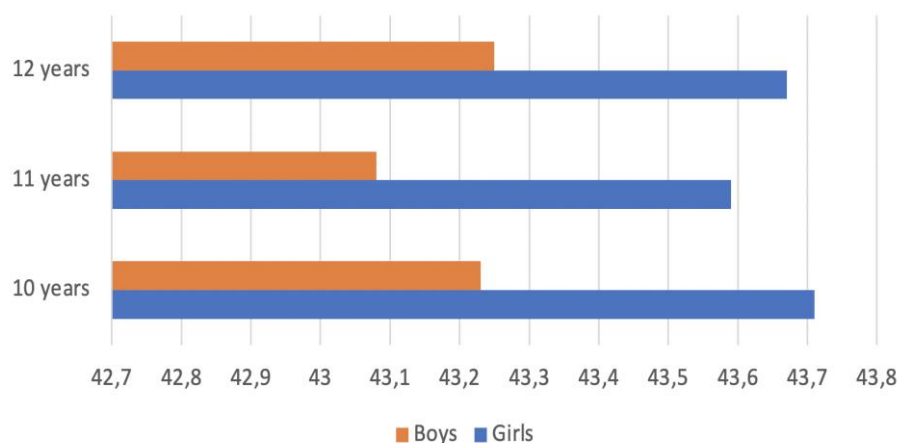
**Table 1. Descriptive Statistics of Variables Used**

Variable	Group	N	Minimal	Max	Means	SD	Tilt		Kurtosis	
							Statistics	SE	Statistics	SE
Age	10 years	115550	0,21	78.12	43.48	0,57	0,17	0,004	-0,68	0,009
	11 years old	166303	0,01	79.24	43.33					
	12 years old	15404	0,36	76.15	43.43					
Gender	Man	152757	0,04	78.12	43.15	0,49	0,06	0,004	-1,99	0,009
	Woman	144500	0,01	79.24	43.65					
Region	3T	2183	1.56	67.83	44,75	0,41	1.28	0,004	0,653	0,009
	Area	237775	0,01	78.12	43.46					
	City	57299	0,05	79.24	43.06					
Numeracy Score		297257	0,01	79.24	43.39	9.95	-1.159	0,004	2.35	0,009

**Table 2. Results of Regression Analysis of Variables Used**

Model	Unstandardized Coefficients		Standardized Coefficient	T	Say
	B	Std. Error	Beta		
	(Constant)	44.173	.360	-	122.732
Age	-.050	.032	-.003	-1.552	.121
Gender	.493	.037	.025	13.480	.000
Region	-.449	.045	-.018	-10.005	.000

Figure 1 shows the average numeracy scores in three age groups based on gender (men and women). The table shows 152,757 male students and 144,500 female students, indicating the dominance of male IMCA participants (51.39%) compared to female (48.61%). However, female students have a higher average numeracy score than male students. This phenomenon is interesting to study further. The average numeracy score based on gender compared to age is presented in Figure 1.



**Figure 1. Average Numeracy Scores by Gender Compared to Age**

Figure 1 shows that the highest numeracy skills of male students are in the 12 year age group and female students are in the 10 year age group. This fact shows that there are differences in numeracy abilities based on age groups between male and female students. This difference shows that men tend to be slower to develop their verbal abilities than women. The slow verbal or language skills of male students will have an impact on the daily learning process. This condition allows female students to have

more knowledge than male students. Language skills and knowledge contribute to the level of students' numeracy abilities. Therefore, further exploring other factors that may contribute to this phenomenon is important. Apart from looking at numeracy literacy skills based on gender, regional aspects related to student age need to be analyzed. Because Indonesia has various regional categories. Differences in numeracy abilities between age groups between male and female students may not occur in all regions of Indonesia. Therefore, it is important to group regions into 3T, districts and cities. In this way, intervention facilitation in the learning process can be provided better. IMCA 2022 involved 2,183 students from 3T areas (0.73%), 237,775 students from districts (79.98%), and 57,299 students from cities (19.28%), showing the dominance of the number of participants from district areas. The IMCA results (not yet linked to student age) show that the average numeracy scores for students in the 3T region, district and city are 44.75, 43.46 and 43.06 respectively. The 3T area student data is unique. Students from 3T areas tend to have limitations in the field of infrastructure. Even so, they can still outperform students from other regions that have adequate infrastructure to support the learning process. Generally, the status of a region greatly influences the availability and quality of examination facilities and learning infrastructure. . Average Numeracy Values Based on Regional Status Compared to Age are presented in Figure 2.

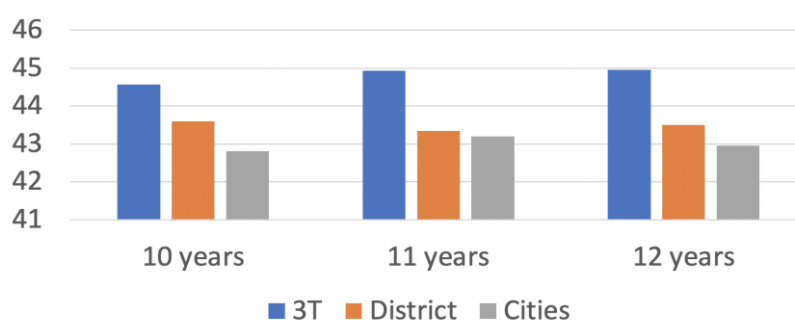


Figure 2. Average Numerical Value Based on District Status Compared to Age

Figure 2 presents the numeracy skills of Indonesian people *madrassa* students based on regional status regarding their relative age. Interestingly, the average numeracy score for students in the 3T area is highest among students in the 12 year age group. In contrast, students from districts and cities have the highest average scores at ages 10 and 11 years, respectively. This information shows that each region has a different optimal age group, thus providing room for further investigation into the causal factors.

### Discussion

This section discusses sequentially the IMCA numeration results based on age categories (10, 11, and 12 years), the IMCA numeration results based on gender categories (male and female) associated with the relative age of students, and the IMCA numeration results based on region (3T, district, and city) is associated with the relative age of students. Each discussion is carried out in an interrelated and complementary manner. The data presented in the previous section shows that students in the 10 year age group have a relatively higher average score (43.48) than the other two groups. However, statistically the difference is not significant. In other words, small differences in average scores tend to be negligible. However, if we look closely or relate it to gender (male and female), it can be seen that males reach their peak numeracy ability at the age of 12 years. In contrast, girls achieve it at the age of 10 years (Aune et al., 2018; Soneira, González-Calero, & Arnau, 2021). The intersection of the gender gap and the Relative Age Effect (RAE) adds complexity to the classroom learning environment. This complexity arises because learning occurs in mixed gender classes, where some students may experience advantages or disadvantages due to these dynamics. Such scenarios can impact cognitive, social, and emotional skills (Beier & Blossfeld, 2023; Faris & Felmlee, 2011a; Verachtert et al., 2020). On the other hand, if we study the human brain, there is an important component known as the inferior parietal lobule, which has great significance in mathematics learning. This region is more prominent in men, thereby increasing visual-spatial abilities compared to women. In the age range of 10 to 13 years, boys see an increase in visual-spatial abilities, while girls show better mastery of verbal skills (Perez Mejias, McAllister, Diaz, & Ravest, 2021; Thompson, Barnsley, & Battle, 2020). Given the coupling of spatial and verbal skills in boys and girls, as mentioned previously, it is logical to anticipate that this may lead to small differences in numeracy abilities between boys and girls, given their age differences. The same database but the sample coverage is limited to East Java. Both studies confirmed that students in the 11 year age group had the highest numeracy literacy scores compared to other age groups (although the difference was not significant).



There are no differences in results between the East Java sample database and national data. This does need to be confirmed by previous research which shows that older students tend to have better academic abilities than younger students (Krutetski, 2022; Whitely et al., 2021). Logically, students who take IMCA at the age of 10 are those who enter MI at the age of 6. In contrast, 11-year-old students are enrolled at 7 years old. Based on the Ministry of Education and Culture Regulation Number 51 of 2018 concerning prospective new students in class 1 of elementary schools (state and *madrassa*), both age groups are still within the age range determined for their learning readiness. At the age of 6 or 7 years, students can potentially enjoy learning tasks and maintain good attitudes and behavior towards teachers and peers in the school environment. States that children in this age group are predicted to be able to complete academic assignments in subsequent grades, including grade 5, when taking IMCA.

Students aged 12 years who take IMCA can experience delays in class V. These delays can be triggered by two factors: late entry into MI (they registered at the age of 8), and not passing grades. promotion. In a psychological context, children in this group are classified as slow learners (Roeser, 2020; Widikasih, Widiani, & Gede Margunayasa, 2020). They generally have slower learning abilities than their peers. Students who are slow learners need more time than other students with the same level of cognitive skill potential. They also often complete academic assignments late compared to their peers (Grasby, Coventry, Byrne, Olson, & Medland, 2022). In addition, the data illustrates that students who have the highest average numeracy skills are male students in the 12 year age group and female students in the 10 year age group. The relatively earlier age of female students in their numeracy skills cannot be separated from the type of questions used to test their numeracy skills. Counting questions at IMCA always begin with a stimulus or text, so students must read and understand the stimulus first. Students need reading skills in addition to math skills. The reading fluency levels of male and female students reached 38.71% and 53.19% respectively. The lower reading ability of male students compared to female students is caused by their psychological development (Gray et al., 2019; Widodo, Indraswati, Haryati, Syazali, & Anar, 2022). Female students have a better interest in reading than male students. Male students tend to be indifferent, chat more with their classmates, get bored easily, and become discouraged when they have difficulty reading. On the other hand, when they have difficulty reading, female students still try to read even with the help of the teacher. Female students are also more enthusiastic than male students. They found that gender differences existed in a variety of reading, numeracy and science outcomes. Although girls outperform boys in reading, boys outperform girls in math and science (Aalst & Tubergen, 2022; Baye & Monseur, 2020; Gray et al., 2019). Numeracy skills are also influenced by gender, male students have an advantage in mathematical reasoning abilities, while female students are superior in accuracy and thoroughness in mathematical thinking. Based on a developmental psychology perspective, the results of this study are also in line with (Beier & Blossfeld, 2023; Krutetski, 2022; Wardhana, Kharisma, & J., 2023). Where men tend to be slower in language development than women. Language delays can have broader cognitive, social and emotional consequences. Language delays will also have a significant impact on the daily learning process when solving numeracy problems.

Regarding the IMCA results in the 3T area with the highest average, it can be assumed that there are very few IMCA participants from this area, and the selected participants have good internet access. This condition occurs because not all *MADRASAH* is registered as a participant in IMCA 2022 because he is only targeting 50% *madrassa* from each region. However, this section also needs to explain the conditions of the 3T area to balance the reader's understanding and enrich the analysis. Referring to the Circular Letter of the National Development Planning Agency (BAPPENAS) dated April 21 2015, the 3T (Outermost, Frontier and Disadvantaged) region includes 26 provinces, 142 districts/cities consisting of the outermost regions in 9 provinces with a total of 9 districts/cities and 20 regions, leading areas in 8 provinces with 23 regencies/cities, and underdeveloped areas in 22 provinces with 99 regencies/cities. The 3T region has inadequate infrastructure and many problems in providing education, including the difficulty of building standard educational facilities and limited teaching and learning media (Black et al., 2010; Musch & Grondin, 2010). Based on the explanation above, the target is selected *madrassa* IMCA 2022 will have performance as previously explained. However, there are also those who are skeptical when receiving and reading the data above. Therefore, it is necessary to further investigate the numeration results and conditions on the target *madrassa* IMCA 2022 is required. Illustrations can be in the form of numeracy results with teacher abilities, the influence of numeration with existing media, numeracy results with management systems, and numeracy results with learning facilities and infrastructure. In terms of age, the highest average student numeracy scores are in the 3T area, especially students aged 12 years. This fact is interesting because people in 3T areas are different from people in urban areas who are aware of the importance of education for their children. In the 3T area, public awareness about sending children to school is still low. The people in this area have a simple view or idea of only meeting the needs of their family and community. Accessibility to *madrassa* poor, because students have to cross the river to get to

school. These barriers prevent students from enrolling *madrassa* at the age of 6 or 7 years. So, the older they are, the stronger they are in facing difficult natural obstacles in accessing school.

However, behind these findings, there is an important analysis that requires attention. First, students taking IMCA in 2022 face and answer questions that are different from previous exams for the first time. In previous assessments, they consistently encountered questions without preliminary reading or stimulus. This scenario is different when answering IMCA questions, which are all based on readings, texts, or infographics, forcing them to understand the content before answering the questions. As a result, they experienced a very sudden transition. Students face cognitive surprises during the transition from conventional problem solving to IMCA model questions (Craig, 2018). The transition phase presents a tough challenge for students, even for students who are already experienced in PISA tests, because adjustments are still required (Craig, 2021; Norqvist, Jonsson, & Lithner, 2022). Second, IMCA, in its field administration, applies computer-based testing using the Multistage Adaptive Tests (MSAT) basis. The implementation of online tests has produced significant impacts and surprises for students. Research conducted by Lintas et al. (2023) revealed that challenges in online exams, such as students' unfamiliarity with application features, limited online exam support facilities (such as limited internet and PC access), and less than optimal socialization, are quite big obstacles. Students' proficiency in using exam applications is still an obstacle in situations like this (Prasetyanto, Maharddhika, Ruminar, & Prasetyaningrum, 2023; Widikasih et al., 2020). In particular, students who have previous experience with online exams usually face more challenges than those who do not.

The results of this study show that although it is not statistically significant, ten year old children have a higher average score than the other two groups. The next finding is that students' numeracy skills are influenced by their gender. Based on the findings of this research, teachers need to consider students' gender so that teachers can provide relevant learning facilitation for optimal development of students' numeracy skills (Cross, Aristeidou, Rossade, Wood, & Brasher, 2020; Gold, Duzy, Rauch, & Murcia, 2023; Pemotongan & Lowrie, 2022). Statistical data processing found differences in the ages of male and female students in terms of best numeracy skills. Another finding in the 3T area is that the best numeracy skills are found at the age of 12 due to challenges in obtaining education. Some of these findings can be used as material for consideration by the government in formulating policies and implementing programs, especially in improving numeracy skills among *madrassa* students and 3T districts, cities and regions (Pangeran & Frith, 2020; Quirk, Grimm, Furlong, Nylund-Gibson, & Swami, 2021; Umar, Kusaeri, Ridho, Yusuf, & Asyhar, 2022). However, the limitation of this research is that it only uses numeracy literacy data from IMCA. Data collected from surveys or direct interviews at *madrassa* locations do not prove this. A comprehensive picture of a participant's potential and competency will be lost when test results are the only information considered. This is due to the fact that students between the ages of 10 and 12 usually do as their teachers tell them, even when solving arithmetic and reading problems. The implications of research regarding the relative influence of age, gender and regional differences on students' numeracy levels in *madrassa* competency assessments in Indonesia are very broad and significant for the development of education policy. The findings of this research can help policy makers and schools in designing more targeted interventions to improve students' numeracy skills. For example, if it is found that a certain age has a strong correlation with numeracy ability, then the teaching program can be adjusted to maximize the potential of students at that age. Likewise, if there are significant differences based on gender, special efforts such as mentoring programs or gender-sensitive learning activities can be implemented to address these gaps. In addition, research results showing disparities in numeracy abilities between regions can encourage a fairer distribution of educational resources, including improving the quality of teachers and educational facilities in less developed areas. Overall, the implications of this research are expected to encourage the creation of a more inclusive, fair and sustainable *madrassa* education system, as well as improve the numeracy achievements of students throughout Indonesia.

#### 4. CONCLUSION

The study found that older students demonstrated higher numeracy abilities, indicating that cognitive development with age contributes to better academic achievement. In addition, there are significant gender differences, with male students tending to have higher levels of numeracy than female students, reinforcing several previous research findings indicating a gender gap in academic achievement, although these results still vary across studies. These findings emphasize the importance of more inclusive and equitable education policies, to overcome existing inequalities and improve the quality of education in all regions of Indonesia. Thus, this research not only strengthens existing literature but also provides new

insights that can be used as a basis for more effective policy making in improving the numeracy skills of madrasah students in Indonesia.

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