

# Algebraic Literacy among Pesantren-based Senior High School Students

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## ABSTRACT

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Mathematics is a vital means needed by students to solve various problems, both personal and social, and it is required to succeed in work. Thus, students are highly expected to possess good mathematical literacy. In the 21<sup>st</sup> Century, most of parents would rather choose pesantren-based schools for their children since they believe that theirs will have chance to acquire universal and religious sciences, at once, for their life. Further, the current research was aimed to investigate level of algebraic literacy among pesantren-based senior high school students, along with its determinant factors. Qualitative research method was employed by means of descriptive approach. Moreover, there were 30 students involved in the research; all of which were the twelfth graders of Science Class of a pesantren-based senior high school in Madura, Indonesia. To collect data, two instruments were used: algebraic literacy test and guideline to interview with the Math teacher and the Vice Principal of Curriculum Affairs. The results showed that level of algebraic literacy among students was dramatically low, with 94% of whom classified in below Level 1, 3% in Level 2, and 3% in Level 3. Moreover, lack of student's focus in learning Mathematics was one of possible causes of it as the students were strongly demanded to learn about two major sciences at once. Therefore, any endeavors for betterment from the teacher and institution are needed to make algebraic literacy among students get improved; one of which can be by integrating pesantren and national education curricula.



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## A. INTRODUCTION

As a part of modern community, students are always required to be able to solve any problems that happen to life, whether in personal, social, work, and science cases (Johar, 2012). To deal with the problems, Mathematics appears to be an important means to get the solutions (OECD, 2016). However, in real-life practices, students are still found in trouble when trying to formulate and evaluate mathematical problem-solving in real-life contexts (Dewantara, Zulkardi, & Darmawijoyo, 2015; Edo, Hartono, & Putri, 2013). It occurs because Mathematics taught in schools is basically different from that which they need for work, with the former having limitation of relevance (van der Wal, Bakker, & Drijvers, 2017).

Moreover, Math instructions held at schools must be able to develop and improve knowledge of students so as to make them well-equipped at solving particular problems (Sumirattana, Mekanong, & Thipkong, 2017). Any of curricula implemented at schools need a specific approach that accommodates the actual implementation of conceptual mathematics

into real-life practices (Prince & Frith, 2020; Rosa & Orey, 2015). Basically, mathematical literacy is referred to as a package of skills for mathematical reasonings and applying concepts, procedures, facts, and mathematical elements to describe, explain, and predict certain phenomena that regularly happen in real life (Geiger, Goos, & Forgasz, 2015; OECD, 2016). In addition, mathematical literacy is a necessary skill that must be possessed and thoughtfully considered by schools (Bolstad, 2019) since it is consistent with a social theory that considers literacy a part of social practices due to minor representativeness of key theories to their real-life practices (Yang, Kuo, & Jiang, 2019).

According to data from PISA (*Program for International Student Assessment*) held by OECD (*Organisation for Economic Co-operation and Development*) in measurement of mathematical literacy in 2013-2018, Indonesia was ranked worse than the OECD's average standard, in the bottom 10 (Kastberg, Chan, Murray, & Gonzales, 2016; OECD, 2019). In addition, research carried out by Wulandari & Jailani (2018) in Yogyakarta showed that mathematical literacy among students was below the OECD's average. In other words, students were still not able to carry out some mathematical procedures, such as understanding and identifying key points of questions, recognizing necessary information, evaluating information quality, and using the information as effectively and ethically as possible (Karimah, 2017; Rahman, Suryadi, & Rosjanuardi, 2017; Wijaya, 2016). Above all, low mathematical literacy among students indicates serious issues that occur in Math instructions (Utomo, 2021). This is illustrated that the mathematical literacy of Indonesian students is very low, including algebraic literacy. Anggriani (2020) found that students' algebraic literacy was low, one of which was caused by the lack of understanding of students in formulating situations and understanding of concepts and the use of symbols.

One of key factors to affect mathematical literacy among students is teacher's competency in conducting instructional processes (Susanti & Syam, 2018), in which an ideal instruction basically requires conceptual understanding about Mathematics and any contents that reflect relevancies to community (Ojose, 2011). However, based on field practices, many teachers do not understand yet about mathematical literacy so as to cause classroom instructions far from the core of which (Genc & Erbas, 2019; Umbara & Suryadi, 2019). Based on previous research by Dores & Setiawan (2015), it was found that mathematical literacy among prospective teachers was relatively low. A series of trainings on mathematical literacy intended for teachers did not cause any significant advances to be transferred to students (Colwell & Enderson, 2016). In addition to teacher factor, there were also some other factors affecting mathematical literacy among students, i.e., personality, socio-economic and cultural backgrounds, and supportive facilities and infrastructures provided for students (Eka et al., 2018; Fajriyah, 2018; Pakpahan, 2016).

Moreover, it is also found that mathematical literacy has close connection with the Holy Qur'an for there are five verses of which that indicate mathematical literacy (R. H. Sari, 2017). It, therefore, implies the importance of Mathematics, not only for public school education but also for pesantren-based one. In the 21<sup>st</sup> Century, most of parents prefer pesantren-based education for their children (Nudin, Abudrakhman, & Indra, 2020) because they believe that theirs can get a 'golden ticket' to acquiring academic and religious competencies (Hendrayana, Mutaqin, & Syamsuri, 2019). Now that current pesantren-based education is potentially

focused on the trend of 4.0 Industry revolution, Islamic education is, indeed, highly required to initiate dynamic and active movements amid globalization era, and, therefore, pesantren-based education can be focused on not only religious teachings, but also science development for the sake of excellence (Daulay, 2012; Fathani, 2019; Hasanah, 2017; S. I. Hasanah, 2014; Ilyasin, 2020; Yaqin, 2012).

A curriculum applied in pesantren-based schools has no standardization since each of pesantren institutions is given the right from the Ministry of Religions to develop its own curriculum in order to preserve its characteristics, in accordance with its existing potentials, cultures, and student's talents (Muazza, Mukminin, Habibi, Hidayat, & Abidin, 2018). In fact, students in pesantren are studying about general subjects in the afternoon, and doing about religious ones at night (Munandar et al., 2020). Basically, pesantren-based school is a school that integrates two curricula, i.e., formal and pesantren education, as a holistic system of education, which is aimed to create religious and educated humans (Nurochim, 2016). Furthermore, pesantren-based school can be promoted as an ideal education institution to uphold Indonesia's national education system (Amrizal, 2011).

A number of research about mathematical literacy and algebraic literacy were held under various themes, such as: mathematical literacy among senior high school students by R. H. N. Sari & Wijaya (2017); literacy achievement amidst senior high school students based on gender by Risywandha & Khabibah (2018); influences of instructional model on student's mathematical literacy by Herutomo, Hajeniati, & Mustari (2020); and algebraic literacy among junior high school students by Anggriani (2020). This research is still limited to describing mathematical literacy and the influence of learning models on mathematical literacy skills and algebraic literacy skills of students in public schools, not yet comparing the algebraic literacy skills of students in Islamic boarding schools.

As an initial endeavor to elevate algebraic literacy or mathematical literacy in PISA survey of 2021, and for the sake of human resource development in pesantren-based schools, it is of importance to conduct research that investigates algebraic literacy of students in pesantren-based schools with its determinant factors. It is also urgent to help the schools create high-quality graduates who can significantly contribute to national building considering the fact that since in the past, there have been many pesantren graduates who have been successful at being leaders, and active in realization of the national building program until now (Thahir, 2014). Algebra is considered urgent since it constitutes a vital component included in the universal Mathematics curriculum over the whole world (Leng, Park, Holton, & Clarke, 2014). As a matter of the fact, students are highly required to acquire the entire contents of which in support of their learning achievements (NCTM, 2000). Thus, it is quite interesting to do research on level of algebraic literacy among pesantren-based senior high school students with its determinant factors, and findings of which are highly expected to be able to help Math teachers and Vice Principals of Curriculum Affairs in pesantren-based schools manage their Mathematics instructions well. The current research was aimed to investigate level of algebraic literacy among pesantren-based senior high school students, along with its determinant factors.

## B. METHODS

Qualitative research method by means of descriptive approach was employed, which suited the ultimate aim of the research – to analyze level of algebraic literacy among pesantren-based school students. Basically, qualitative research is considered a contextual study, which means that it is only aimed for a specific phenomenon that occurs, and has nothing to do with generalizing research findings (Nugrahani, 2014). Furthermore, 30 twelfth graders from Science Class of an Islamic/pesantren-based Senior High School (MA) in Madura, who already attended Mathematics instructions in Academic Year of 2020/2021, were recruited as the research subjects. Subjects were selected purposively according to the research objective, namely to describe the level of algebraic literacy of high school students (SMA) based on Islamic boarding schools and the considerations of teaching teachers. In addition, two instruments, i.e., algebraic literacy test and guideline to interview with the Math teacher and Vice Principal of Academic Affairs, were used. Moreover, the test was used to identify level of student's algebraic literacy in written, while guideline to semi-structured interview was employed to seek in-depth and wide-ranging information so as to make data collected on the student's test more reliable. In addition, algebraic literacy test consisted of 6 PISA's essay questions in total.

To check data validity, source and technique triangulations were carried out. Source triangulation is a procedure to check data validity according to numerous data sources (Sugiyono, 2016). In fact, data sources for this current research included students, teacher, and Vice Principal of Academic Affairs. Technique triangulation, on the other hand, is a particular procedure to check validity of data from the same sources, but with different techniques (Sugiyono, 2016). As mentioned earlier, some techniques used in the research encompassed algebraic literacy test, interview, and documentation. Moreover, data analysis technique used in the research was based on a model proposed by Miles and Huberman (1984) as cited in (Sugiyono, 2013), including data reduction, data presentation, and conclusion. In the current research, indicators of algebraic literacy used were based on PISA's standard levels that were referred to OECD (2016), as follows in Table 1.

**Table 1.** Indicators of algebraic literacy

Levels	Indicators	Descriptions
1	Subject is able to answer questions given by using existing relevant information, and the questions are elaborated in details	<ol style="list-style-type: none"> <li>1. Subject is able to identify information.</li> <li>2. Subject is able to operate routine procedures based on direct instructions.</li> </ol>
2	Subject is able to interpret particular contexts to be used through direct inference.	<ol style="list-style-type: none"> <li>1. Subject is able to extract relevant information from a particular source.</li> <li>2. Subject is able to make use of particular algorithms, formulas, procedures, or basic conversions in solving/answering problems.</li> <li>3. Subject is able to interpret/conclude based on findings.</li> </ol>
3	Subject is able to operate a specific procedure clearly, and which that needs sequential conclusions.	<ol style="list-style-type: none"> <li>1. Subject is able to interpret and make use of different representations from different sources of information.</li> <li>2. Subject is able to create a simple modelling.</li> <li>3. Subject is able to select and apply a simple</li> </ol>

		procedure for problem-solving.
4	Subject is able to create an explicit model for concrete and complex problems with the inclusion of obstacles in making assumptions.	<ol style="list-style-type: none"> <li>1. Subject is able to select and integrate different representations.</li> <li>2. Subject is able to directly relate a concept with the real life.</li> </ol>
5	Subject is able to develop and work with modelling amid complex situations.	<ol style="list-style-type: none"> <li>1. Subject is able to identify obstacles and make assumptions.</li> <li>2. Subject is able to select, compare, and evaluate the best strategy for problem-solving.</li> <li>3. Subject is able to activate creative thinking and make comprehensive reasonings.</li> <li>4. Subject is able to formulate and communicate interpretations complete with good reasonings.</li> </ol>
6	Subject is able to create a certain concept, in addition to generalizing and making use of existing information based on investigation and modelling of problems.	<ol style="list-style-type: none"> <li>1. Subject is able to integrate numerous sources of information and representations for specific problems.</li> <li>2. Subject is able to apply a concept and understanding of operational acquisition and mathematical symbols when making use of new approaches and strategies</li> <li>3. Subject is able to accurately formulate and communicate proper responses to findings.</li> <li>4. Subject is able to interpret and make arguments in the real-life contexts</li> </ol>

## C. RESULT AND DISCUSSION

### 1. Results of Student's Algebraic Literacy Test

According to data from the test's results, it was found that around 15 students did not take the test, 4 students rewrote the questions and gave answers without providing mathematical steps/procedures, and 11 students only answered Question 1 and 3, equal to Level 2 and 3 in PISA's standard levels for mathematical literacy. Out of the 11 who answered those two numbers, only 2 of which could answer the two correctly. In fact, only one student succeeded in answering Question 1, while the other gave correct answer for Question 3. Further, the results from both of the students were analyzed, as shown in Figure 1.

1.  $60 + 0,05x = 74$   
 $0,05x = 74 - 60$   
 $0,05x = 14$   
 $x = \frac{1400}{5}$   
 $= 280$   
 jadi Dina menjual 280 koran dalam seminggu

Figure 1. The test's result from Student 1

Figure 1 illustrates how Student 1 answered the test for Question 1. It is shown that the student could answer it correctly. Relevant information from one source could even be extracted properly, which was affirmed by the result of unstructured interview with the

student. Based on the transcription of interview, the researcher, hereinafter, is marked by (P), while Student 1 by (S1), as follows.

- P : Why was this written as “ $60 + 0.05x$ ”, instead of “ $74 + 0.05x$ ”?
- S1 : Because it is clearly stated in the question that Dina could get 74-zed per week, so the operation is supposed to be “ $60 + 0.05x$ .”

Based on the interview result with Student 1, it is quite clear that the student was already able to extract relevant information from one source, which, in this case, was an information box of Indonesia’s newspapers selling, and it was integrated with other existing information in the question to create a mathematical modelling. In fact, the student could answer such a question quite well and correctly, which was reaffirmed by the result of interview as follows:

- S1 : So, there are a total of 280 newspapers that are already sold by Dina.
- P : Anyway, why don’t you work on the other questions?
- S1 : I don’t really know which one to work on. I’ve tried, but those are so hard.

With reference to the aforementioned excerpt of interview, it is shown that Student 1 could make use of algorithm, formula, procedure, and basic conversion to answer. Further, the student was also able to produce interpretation or conclusion on the basis of findings. In fact, the student, in the interview, also admitted that the questions were so hard to answer since such kinds of which were never given, as shown in Figure 2.

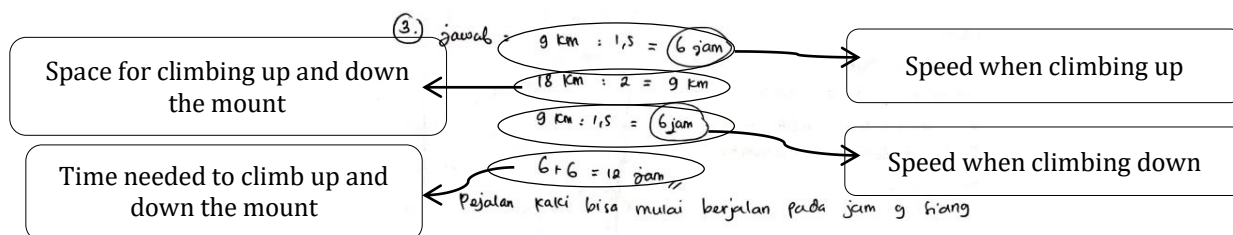


Figure 3. The test’s result from Student 2

Figure 2, moreover, illustrates how Student 2 (S2) worked on the test, especially for Question 3. The student, in fact, could answer the question correctly despite the mistaken start of answering, as shown in Figure 3. The following is the excerpt of unstructured interview with Student 2 (S2).

- P : Please tell me something about your work.
- S2 : So, here’s mentioned that space between Ranu Pani walking path and Mahameru summit is about 9 km. Thus, from base to top, and *vice versa*, the climbers need to walk through 18 km on the pathway. If they are required to reach the base at 8 p.m., so calculation is estimated as “ $18:2 = 9$ ”.

Nonetheless, when in-depth interview was carried out, the student was aware of his mistake for he was less careful at understanding the gist of the question, and finally made correction on it. In fact, Student 2 could interpret and make use of existing representations according to different sources of information. The following figure illustrates his answer after correction, as shown in Figure 3.

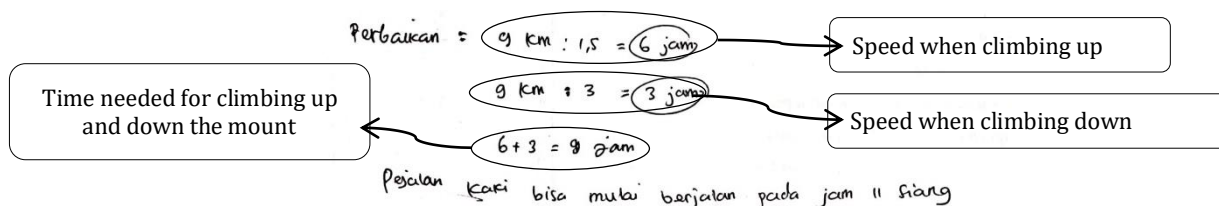


Figure 3. The corrected answer made by Student 2

The following excerpt of interview illustrates how the student was led to making correction.

- P : So, it's not "6 + 6", is it?
- S2 : No, it's supposed to be "6 + 3 = 9 hours".
- S2 : So, the climbers can start for a walk at 11 a.m.

According to the interview result, it is shown that the student was aware of his mistake after being interviewed using the question item number 8, regarding speed of the climbers that was doubled when climbing down the mount. In addition, Student 2 was already able to interpret and make use of representations according to different sources of information. He could define the time needed to climb down based on data of the climber speeds; speed to climb down was two-time faster than that of to climb up. This finding was considered one of key internal factors to affect algebraic literacy among students. Furthermore, the results found in the student test are presented in Table 2 as follows.

Table 2. The results based on the student test

Descriptions	Number of Students	Percentages
Level 1	28	94%
Level 2	1	3%
Level 3	1	3%
Total	30	100%

According to Table 2 above, it is evident that as many as 94% of the subjects were ranked in < Level 1, 3% in Level 2, and 3% in Level 3. In fact, those ranked in below Level 1 were strongly dominant, and this finding affirms that algebraic literacy among the majority of students was still dramatically low.

## 2. Results of Interview with the Teacher

After test and interview were conducted with students, the other interview session was held with the teacher. In addition to interview, the researcher also attempted to observe necessary documents, basically through identification on Lesson Plans for Algebra. However, only Lesson Plans for Algebraic Limit was given by the teacher since all of the lesson plans were designed in uniformity; only the materials differed. The Lesson Plans designed by the Math teacher, especially on algebraic limit topic. The figure, in addition, depicted that stimulus activity was given in the beginning of instruction, before the whilst stage, to provoke students to get engaged in relating the topic with their personal experiences. The foregoing was confirmed by the teacher (G) through the interview as included in the following excerpt of the interview.

P : Well, have you ever provided your students with any specific problems that are relevant to their daily experiences?

G : Sure. At the beginning of the instruction, I commonly do. For instance, I ask them to try to find out the height of the flag pole to demonstrate a concept of trigonometry.

According to the results from interview, the teacher commonly gave initial stimulus in the beginning of instruction by asking them to think of any problems related to their daily experiences. Nevertheless, the problems were still considered simple, instead of complex ones that highly required higher-order of thinking skills, as shown in the excerpt of G above.

Meanwhile, also according to Figure 5, literacy activity was present in whilst phase of instruction, but the core contents of which were just too simple for the teacher was only concerned on giving motivation and guidelines/materials to study, observe, read through, and rewrite. It means that problems irrelevant to student's life were so strongly dominant for literacy activity compared to those the relevant. In addition, student's exposure to questions that needed higher-order thinking skills and problem-solving was still limited, which could affect mathematical literacy, especially the algebraic, among students. The following is the results of interview with the teacher.

P : During the Math instructions you held, especially in Algebra topic, did you ever provide your students with some questions or exercises that needed higher-order thinking skill, PISA, or TIMSS?

G : I commonly did because there were actually three levels of tasking for which I asked my students to do: MOTS, LOTS and HOTS.

P : If it's to be converted into a percentage, how much will you estimate giving your students projects or tests that require HOTS, PISA, or TIMSS within the instructions you held?

G : Maybe just 25%.

In respect of the above excerpt of interview, it can be seen that the teacher regularly provided students with projects or tests that required HOTS, but only with a relatively small portion out of the whole tasks he gave, 25%. Such a fact was quite potential to be one of external factors to affect algebraic literacy among students.

### 3. Results of Interview with the Vice Principal of Academic Affairs

The excerpt of interview with the Vice Principle of Academic Affairs (W) is presented as follows.

P : Considering the fact that this school is pesantren-based, what kind of curriculum is implemented in the school?

W : It's based on the national curriculum.

Based on the results of interview above, it is clear that national curriculum was implemented in the school. In fact, national curriculum is similar to which that is commonly implemented among State Islamic Schools (MAN) without getting interfered by pesantren-based curriculum. In addition, the national curriculum was applied in the morning, and it has been running since the school was firstly established. Thus, morning school activities were different from pesantren-based ones.



W : If we're using a range of percentage, 75-85% of which is achieved, while the remaining 15-25% can't be attained because of internal and external factors and lack of time portion.

P : So, the portion of unachievability is because of long holiday, isn't it? That's quite different from public schools in common, right?

With reference to the results of interview, it is obvious that learning outcome achievability could only reach 75-85% due to some determinant factors. The two key factors that influenced were related to the pesantren programs, homecoming time and Islamic teachings education. Those mentioned causes fell into external factors that influenced algebraic literacy among students.

P : All this time since the beginning of the school, how many changes of curriculum did the school already undertake?

W : Actually, we're only following national curriculum transformations, from 2006 KTSP (School-Based Curriculum), 2013 Curriculum, and now Literacy and Numeracy Curriculum. If National Curriculum is changed, we also make adjustments on our curriculum.

According to the results of interview above, it is known that curriculum change is about to come, from 2013 Curriculum to Literacy and Numeracy one. Most of countries adopted PISA's notions as a reference to national assessment and curriculum review in order to elevate the quality of instructions. In addition, PISA was used to demonstrate certain competencies through basic mathematical skills for the countries believed that the skills would be beneficial for their citizens in the future (Stacey et al., 2013). One of contents included in PISA was *change and relationships*, which was one of mathematical topics that discussed Algebra. Moreover, algebraic contents tested in PISA covered patterns, functions, and variations that could be reproduced in chart, numerical, spatial, and symbolic representations (OECD, 2009). The finding showed that level of algebraic literacy among students was still categorized low. Of 15 students, only 2 of which answered correctly: for Question 1 representing Level 2 and Question 3 representing Level 3 of mathematical literacy.

Low algebraic literacy, in fact, was consistent with the previous PISA assessment results in 2018. The latest exercise of PISA had ranked Indonesia worse than the standard average of OECD, and such a result was not significantly different from that of in 2015. The results showed that as many as 40% of Indonesia's students were ranked in below Level 1, 30% in Level 1, 18% in Level 2, 8% in Level 3, 3% in Level 4, 1% in Level 5, and 0% in Level 6 (OECD, 2019). That unsatisfying result implied that significant improvements were so needed, especially in terms of education system and other supportive elements. In fact, algebraic literacy is not so different from mathematical literacy in common (OECD, 2009). Nevertheless, the results of the current research could not be compared yet to those of national algebraic literacy assessment among students since the national assessment held by the Ministry of Education and Culture was cancelled, and would be conducted in October-November 2021 (Kemdikbud, 2021).

Moreover, as regards the results of interview with students, it is shown that they were not so accustomed to working on PISA-typed questions, or any others that required HOTS and TIMSS, which made them in trouble when answering the algebraic literacy test. Persistent

with Kholifasari, Utami, & Mariyam (2020), it is claimed that lack of competence in understanding questions, selection of strategies, and rules of operation constituted the factor that potentially affected student's literacy level.

In addition, based on the results of interview with the teacher and analysis of Lesson Plans used for instructions, it demonstrated that the teacher regularly exposed students to real-life problems, though in minor portion and at simple level, that did not really need higher-order thinking skills. In addition, referring to OECD (2009), it is said that each of strategies for problem-solving on PISA's questions did not apply routine procedures that could enhance students through questions that were able to provoke them to make argumentations. Meanwhile, at the school, literacy activity was only focused on teacher's giving motivation and supportive materials and guidelines for them to study, learn, and rewrite, instead of on giving relevant problems based on student's real-life experiences. More dramatically, only 25% out of the whole exercises were focused on life-based problems, which could be the cause of low mathematical literacy among students, especially in terms of algebraic one, considering the important role of the teacher during Mathematics instruction (Shadiq, 2019). In addition, the teacher's mathematical competence also significantly contributed to instructional practices (Stahnke, Schueler, & Winter, 2016). The fact that different person faced different experiences, dependent on certain situations and conditions, required the teacher to be more aware of the difference so that problems to be adopted could be well-packed based on existing mathematical concepts (Ikeda, 2013).

Furthermore, with respect of the results of interview with the Vice Principal of Curriculum Affairs, National Curriculum was implemented in the school, and it was separated from the interference of pesantren-based curriculum. Thus, there was not any correlation between school and pesantren activities. Moreover, the achievability of student's learning outcomes on implemented curriculum reached 75-85% due to some determinant factors. Besides, Islamic teachings education held at night overtime caused students feel fatigued and energy-drained, which made them less concentrate and feel demotivated when attending formal school in the morning. Basically, students in pesantren are highly required to acquire two major sciences, religious and universal (Hasanah, 2014).

Furthermore, demanded to acquire two major sciences, most of students often felt in trouble as described earlier by the Vice Principal. It was because of studying in Islamic teachings education overtime at night, which made them feel heavily fatigued and less focused in the morning. Therefore, changes for betterment in the exercise of Mathematics instructions at schools were needed, especially on the teachers, to facilitate student's Mathematics learning process (Fathani, 2019). At the end, it was highly expected that students felt optimistic and enjoyed learning Mathematics. Further, in order to elevate level of mathematical literacy, especially on Algebra, among students, imitating other countries with good mathematical literacy based on PISA is necessary; one of which is Germany. In fact, Germany is one of countries that demonstrates excellent PISA's performance much higher than the standard average of OECD (OECD, 2019).

One of the reasons why Germany is so excellent for PISA assessment is because PISA has been set as the supreme indicators for the best quality assessment of the school system, which positively affects Mathematics instructions at schools (Prenzel, Blum, & Klieme, 2013). These

endeavors and approaches used could be an ideal example to transform education system in its all levels in order to elevate the quality of instructions and maintain mathematical literacy among students because low level of mathematical literacy might indicate serious problems in Mathematics instructions (Utomo, 2021). Fortunately, student's literacy in Indonesia has been a serious concern for Indonesia's Governments since, according to the interview with the Vice Principal. a new concept of School-Based (KTSP) Literacy and Numeracy Curriculum is going to be released, though it is applied yet in most of schools due to Technical Guideline for teachers that is still being run. After that, it is expected that the implementation of which suits the primary goals of national assessment that will be set as the referral parameter for student's mathematical literacy, which would be delayed until September – October 2021 (Kemdikbud, 2021). All in all, the current research is highly expected to be able to bring about exclusive inspirations for the school in the preparation of prospective national assessment.

#### **D. CONCLUSION AND SUGGESTIONS**

In respect of research findings as elaborated above in the previous chapter, it can be concluded that basically, level of algebraic literacy among students was quite low. To be specific, around 94% of students were ranked in below Level 1, 3% in Level 2, and 3% in Level 3. In general, there were two factors that appeared to be the cause of which, internal and external. The internal factor was related to the student's being less accustomed to working on PISA-typed questions, which made the students feel in trouble when having to answer the test. Meanwhile, the external factor was closely associated with the Math teacher when teaching and pesantren programs. It was found that the teacher gave students limited access to working on problems or questions relevant to their daily experiences and allowing them for doing problem-solving.

Therefore, with all those findings, endeavors to make some improvements, both from the teacher and school management, are of urgency for realization in order to elevate level of algebraic literacy among students. For prospective researchers, further research on algebraic literacy among students based upon cognitive style perspectives, or student competence is so recommended to be held in the future. In addition, other topic on algebraic literacy in the context of *Tahfidz Qur'an* schools is quite interesting, as well.

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#### **REFERENCES**

- Amrizal. (2011). Sekolah versus pesantren Sebuah Perbandingan Menuju Format Baru Mainstream Lembaga Pendidikan Nasional Peniada Dikotomik. *Jurnal Sosial Budaya*, 8(01), 114–131. The title of the article is written in sentence case/see writing APA Style
- Angriani, V. (2020). *Kemampuan Literasi Aljabar Siswa Kelas VII Yang Ditinjau Berdasarkan Gaya Konitif*. Universitas Pendidikan Indonesia. Publisher? City? See how to write a book reference
- Arora, A., & Pawlowski, E. (2017). Examining Gender Differences in the Mathematical Literacy of 15-Year-Olds and the Numeracy Skills of the Age Cohorts as Adults. *Commissioned Paper*, 1–30. Vol?

Issue?

- Bolstad, O. H. (2019). Teaching for mathematical literacy : School leaders ' and teachers ' rationales. *European Journal of Science and Mathematics Education*, 7(3), 93–108.
- Colwell, J., & Enderson, M. C. (2016). When I hear literacy: Using pre-service teachers' perceptions of mathematical literacy to inform program changes in teacher education. *Teaching and Teacher Education*, 53, 63–74. <https://doi.org/10.1016/j.tate.2015.11.001> Issue?
- Daulay, H. P. (2012). *Kapita Selektta Pendidikan Islam Di Indonesia* (pertama; S. Nasution, Ed.). Medan: Perdana Publishing.
- Dewantara, A. H., Zulkardi, & Darmawijoyo. (2015). Assessing Seventh Graders' Mathematical Literacy In Solving Pisa-Like Tasks. *Journal on Mathematics Education*, 6(2), 117–128.
- Dores, O. J., & Setiawan, B. (2015). Meningkatkan Literasi Matematis Mahasiswa Calon Guru Sekolah Dasar Dalam Membelajarkan Matematika. *Jurnal Pendidikan Matematika Indonesia*, 4(1), 42–46.
- Edo, S. I., Hartono, Y., & Putri, R. I. I. (2013). Investigating secondary school students' difficulties in modeling problems PISA-model level 5 and 6. *Journal on Mathematics Education*, 4(1), 41–58. <https://doi.org/10.22342/jme.4.1.561.41-58>
- Eka, P., Nuurjannah, I., Hendriana, H., Fitrianna, A. Y., Cimahi, S., & E-mail, K. P. (2018). Faktor Mathematical Habits Of Mind dan Kemampuan Literasi Matematis Siswa SMP di Kabupaten Bandung Barat The Factor Of Mathematical Habits of Mind and Mathematics Literacy Students Ability Of Junior High School Program Studi Pendidikan Matematika , IKIP S. *Jurnal Penelitian Matematika Dan Pendidikan Matematika*, 2(2), 51–58.
- Fajriyah, E. (2018). Peran Etnomatematika Terkait Konsep Matematika dalam Mendukung Literasi. *Prisma, Prosiding Seminar Nasional Matematika*, 1, 114–119. Issue?
- Fathani, A. H. (2019). Pembelajaran Matematika bagi Santri Pondok Pesantren Berbasis Kecerdasan Majemuk. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, 2(1), 48–55. <https://doi.org/10.24176/anargya.v2i1.3043>
- Geiger, V., Goos, M., & Forgasz, H. (2015). A rich interpretation of numeracy for the 21st century: a survey of the state of the field. *ZDM - International Journal on Mathematics Education*, 47(4), 531–548. <https://doi.org/10.1007/s11858-015-0708-1>
- Genc, M., & Erbas, A. K. (2019). Secondary Mathematics Teachers ' Conceptions of Mathematical Literacy. *International Journal of Education in Mathematics, Science and Technology*, 7(3), 222–237.
- Hasanah, N. (2017). Komponen Kurikulum Sekolah Berbasis Pesantren (Studi Komparatif Di SMA Darussyahid Dan SMA Puteri At-Tanwir Sampang). *Interaksi*, 12(2), 70–79.
- Hasanah, S. I. (2014). Sumber belajar matematika dari lingkungan alam sekitar berbasis pondok pesantren. *Interaksi*, 9(1), 28–31.
- Hendrayana, A., Mutaqin, A., & Syamsuri. (2019). The Phenomenon of Boarding School and Its Mathematics Learning. *Al-Jabar: Jurnal Pendidikan Matematika*, 10(1), 159–175.
- Herutomo, R. A., Hajeniati, N., & Mustari, F. (2020). Model Problem-Based Learning Berpendekatan Matematika Realistik untuk Mendukung Literasi Matematis Siswa. *Jurnal Pendidikan Matematika*, 11(1), 25–38.
- Ikeda, T. (2013). Applying PISA Ideas to Classroom Teaching of Mathematical Modelling. In K. Stacey & R. Turner (Eds.), *Assessing Mathematical Literacy: The PISA Experience* (pp. 1–321). <https://doi.org/10.1007/978-3-319-10121-7> Book or Journal?
- Ilyasin, M. (2020). Transformation of Learning Management : Integrative Study of Islamic Boarding School Curriculum. *Dinamika Ilmu*, 20(1), 13–22.
- Johar, R. (2012). Domain Soal PISA untuk Literasi Matematika. *Jurnal Peluang*, 1(1), 30–41.
- Karimah, A. (2017). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal PISA. *Jurnal Ilmiah Pendidikan Matematika*, 1(6), 24–31.
- Kastberg, D., Chan, J., Murray, G., & Gonzales, P. (2016). Performance of U.S. 15-Year-Old Students in Science, Reading, and Mathematics Literacy in an International Context. In *National Center for Education Statistics*. Washington.
- Kemdikbud. (2021). Jadwal asesmen nasional 2021 diundur. Retrieved from <https://www.kemdikbud.go.id/main/index.php/blog/2021/01/jadwal-asesmen-nasional-2021-diundur>

- Kholifasari, R., Utami, C., & Mariyam. (2020). Analisis Kemampuan Literasi Matematis Siswa Ditinjau Dari Karakter Kemandirian Belajar Materi Aljabar. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, 7(2), 117–125. <https://doi.org/10.31316/j.derivat.v7i2.1057>
- Leng, F. K. ., Park, K., Holton, D., & Clarke, D. (2014). *algebra teaching around the world* (D. Clarke, Ed.). Netherlands: Sense Publishers.
- Muazza, M., Mukminin, A., Habibi, A., Hidayat, M., & Abidin, A. (2018). Education in Indonesian islamic boarding schools: Voices on curriculum and radicalism, teacher, and facilities. *The Islamic Quarterly*, 62(4), 507–536.
- Munandar, S., Hanim, Z., Komariyah, L., Kasuma, J., Darma, D. C., & Suliman, A. (2020). Students Admission, Learning Approach and Planning of Boarding School: a Case of Selamat Pagi Indonesia (SPI) High School. *Journal of Critical Reviews*, 7(14), 24–28. <https://doi.org/10.31838/jcr.07.14.03>
- NCTM. (2000). Answer To Frequently Asked Questions About Principles And Standards For School Mathematics. In *Principles and Standards for School Mathematics* (pp. 1–4). Reston, VA.
- Nudin, M. I., Abudrahman, O., & Indra, S. (2020). Motivasi Orang Tua Memilih Pesantren Sebagai Sarana Pendidikan. *E-Journal Skripsi Fakultas Keguruan Dan Ilmu Pendidikan*, 3(1), 14–27.
- Nugrahani, F. (2014). *Metode Penelitian Kualitatif dalam Penelitian Pendidikan Bahasa*. Retrieved from <http://e-journal.usd.ac.id/index.php/LLT%0Ahttp://jurnal.untan.ac.id/index.php/jpdpb/article/viewFile/11345/10753%0Ahttp://dx.doi.org/10.1016/j.sbspro.2015.04.758%0Awww.iosrjournals.org>  
Book or journal?
- Nurochim. (2016). Sekolah Berbasis Pesantren Sebagai Salah Satu Model Pendidikan Islam Dalam Konsepsi Perubahan Sosial. *Al-Tahrir: Jurnal Pemikiran Islam*, 16(1), 69–88. <https://doi.org/10.21154/al-tahrir.v16i1.320>
- OECD. (2016). “PISA 2015 Mathematics Framework”, in *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy*. Paris: OECD Publishing.
- OECD. (2009). *Learning Mathematics for Life “A View Perspective From PISA.”* OECD Publishing. See how to write a book reference
- OECD. (2019). *PISA 2018 Results: What Student Student Know and Can Do*. <https://doi.org/10.1787/5f07c754-en> See how to write a book reference
- Ojose, B. (2011). Mathematics literacy : are we able to put the mathematics we learn into everyday use? *Journal of Mathematics Education*, 4(1), 89–100.
- Pakpahan, R. (2016). Faktor-Faktor yang Mempengaruhi Capaian Literasi Matematika Siswa Indonesia dalam PISA 2012. *Jurnal Pendidikan Dan Kebudayaan*, 1(3), 331–347.
- Prenzel, M., Blum, W., & Klieme, E. (2013). The Impact of PISA on Mathematics Teaching and Learning. In K. Stacey & R. Turner (Eds.), *Assessing Mathematical Literacy: The PISA Experience* (pp. 1–321). <https://doi.org/10.1007/978-3-319-10121-7>
- Prince, R., & Frith, V. (2020). An investigation of the relationship between academic numeracy of university students in South Africa and their mathematical and language ability. *ZDM - Mathematics Education*, 52(3), 433–445. <https://doi.org/10.1007/s11858-019-01063-7>
- Rahman, H., Suryadi, D., & Rosjanuardi, R. (2017). Epistemological Obstacles Experienced by Indonesian Students in Answering Mathematics PISA Test on the Content Uncertainty and Data. *International Journal of Science and Applied Science: Conference Series*, 2(1), 122–129.
- Risywandha, I., & Khabibah, S. (2018). Literasi Matematika Siswa SMA Kelas X Dalam Menyelesaikan Soal Model PISA Ditinjau Dari Perbedaan Gender. *MATHEdunesa*, 2(7), 248–255.
- Rosa, M., & Orey, D. C. (2015). A trivium curriculum for mathematics based on literacy, matheracy, and technoracy: an ethnomathematics perspective. *ZDM - International Journal on Mathematics Education*, 47(4), 587–598. <https://doi.org/10.1007/s11858-015-0688-1>
- Sari, R. H. (2017). Apakah Integrasi Islam dapat Membudayakan Literasi Matematika? *Seminar Matematika Dan Pendidikan Matematika UNY*, 655–662.
- Sari, R. H. N., & Wijaya, A. (2017). Mathematical literacy of senior high school students in Yogyakarta. *Jurnal Riset Pendidikan Matematika*. <https://doi.org/10.21831/jrpm.v4i1.10649> Vol? Issue? Page?
- Shadiq, F. (2019). Pembelajaran Matematika Pada Era Industri 4.0., Suatu Tantangan Bagi Guru dan Pendidik Matematika. *Seminar Nasional Pendidikan Matematika (SNP2M)*, 7–16.

- Stacey, K. (2011). The PISA View of Mathematical Literacy in Indonesia. *Journal on Mathematics Education*, 2(2), 95–126.
- Stacey, K., Almuna, F., Caraballo, R. M., Chesne', J.-F., Garfunkel, S., Gooya, Z., ... Abstract. (2013). PISA's Influence on Thought and Action in Mathematics Education. In K. Stacey & R. Turner (Eds.), *Assessing Mathematical Literacy: The PISA Experience* (pp. 1–321). <https://doi.org/10.1007/978-3-319-10121-7>
- Stahnke, R., Schueler, S., & Winter, B. R. (2016). Teachers' perception, interpretation, and decision-making: a systematic review of empirical mathematics education research. *ZDM*. <https://doi.org/10.1007/s11858-016-0775-y>
- Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (19th ed.). Bandung: Alfabeta.
- Sugiyono. (2016). *Memahami Penelitian Kualitatif.pdf* (Dua belas). Bandung: Alfabeta. We recommend that you use the latest reference
- Sumirattana, S., Mekanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. *Kasetsart Journal of Social Sciences*, 38(3), 307–315. <https://doi.org/10.1016/j.kjss.2016.06.001>
- Susanti, E., & Syam, S. S. (2018). Peran Guru dalam Meningkatkan Kemampuan Literasi Matematika Siswa Peran Guru dalam Meningkatkan Kemampuan Literasi Matematika Siswa Indonesia. *Seminar Matematika Dan Pendidikan Matematika UNY*, 30–35.
- Thahir, M. (2014). The Role and Function of Islamic Boarding School: An Indonesian Context. *International Journal for Historical Studies*, 5(2), 197–208. Retrieved from <https://mindamas-journals.com/tawarikh/article/view/574>
- Thomson, S., Hillman, K., & Lisa De Bortoli. (2013). *A Teacher's Guide to PISA Mathematical Literacy* (First). Australia: ACER Press.
- Umbara, U., & Suryadi, D. (2019). Re-Interpretation of Mathematical Literacy Based on the Teacher's Perspective. *International Journal of Instruction*, 12(4), 789–806.
- Utomo, D. P. (2021). An Analysis of the Statistical Literacy of Middle School Students in Solving TIMSS Problems. *International Journal of Education in Mathematics, Science, and Technology (IJEMST)*, 9(2), 181–197.
- van der Wal, N. J., Bakker, A., & Drijvers, P. (2017). Which Techno-mathematical Literacies Are Essential for Future Engineers? *International Journal of Science and Mathematics Education*, 15, 87–104. <https://doi.org/10.1007/s10763-017-9810-x>
- Wijaya, A. (2016). Students' information literacy: A perspective from mathematical literacy. *Journal on Mathematics Education*, 7(2), 73–82. <https://doi.org/10.22342/jome.v7i2.3532>
- Wulandari, N. F., & Jailani. (2018). Mathematics skill of fifteen years old students in Yogyakarta in solving problems like PiSA. *Journal on Mathematics Education*, 9(1), 129–144.
- Yang, X., Kuo, L. J., & Jiang, L. (2019). Connecting Theory and Practice: a Systematic Review of K-5 Science and Math Literacy Instruction. *International Journal of Science and Mathematics Education*, 18, 203–219. <https://doi.org/10.1007/s10763-019-09957-4> Issue?
- Yaqin, H. (2012). Islamic Boarding School Curriculum In Indonesia: A Case Study in Islamic Boarding School in South Kalimantan. *Jurnal Al-Hikmah*, XIII(1), 18–38.