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Science Literacy Skills of Prospective Primary Education Teachers: Challenges in the 21st Century

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Abstract

The low science literacy ability for Central Java Province is certainly related to educational institutions that produce prospective science teachers. The better and more mature the preparations are made, the more professional the graduates are produced. The purpose of this study is to reveal the phenomenon that occurs in an Islamic university in Surakarta as one of the producers of prospective MI teachers. The aspects measured include the essence of science and how to learn science. The data analysis technique uses descriptive statistics. The findings of this research are distinguished from three major challenges, namely (1) Specialization in the scientific field starts from the selection of science courses that are less accommodating to pay attention to the tendency of interest of prospective MI teachers, (2) the determination of courses should refer to the acquisition of science literacy assessments nationally and the rankings of PISA and TIMSS Indonesia, and (3) It is necessary to provide more intensive debriefing to prospective MI teachers about professionalism competencies.

Keyword: *Religious Education, Content Analysis, Ibtidaiyah Curriculum, Value Erosion, Educational Tolerance*

Introduction

Science literacy is one of the competencies that prospective teachers must master at the basic education level because this ability is one of the subjects that must be taught from the elementary level to the university level, even competing at the national and international levels.

However, the results of the KSM (Madrasah Science Competence) competition at the national and international levels (PISA) have not shown encouraging results. The focus of this research is on cases observed in the province of Central Java. From the official website of the Directorate of KSKK Madrasah, it was found that MI Central Java was ranked 11th nationally, namely MIN 4 Sukoharjo. Next are the results of the KSM competition in Central Java Province. Out of **3971 MI/SD/Equivalent**, only 10 MI/SD ranked as the main champion and hope champion, namely:

Table 1. Ranking of Institutions in Madrasah Science Competency at the Central Java Provincial Level

No	Institution	Level
1	MIN 4 Sukoharjo	First Place

2	MIS Muhammadiyah Karanganyar	First Place
3	MIS Muhammadiyah Taraman	Second Place
4	MIN 9 Sragen	Second Place
5	SD Muhammadiyah Birrul Walidain Kudus	Third Place and Hope I
6	SD Unggulan Terpadu Bumi Kartini Jepara	Third Place
7	MIS Nurul Azhar Terban	Hope I
8	MIS Ma'arif Nu Rabak	Hope II
9	MIN 2 Sukoharjo	Hope II
10	MIS PK Mojolegi	Hope III

Source: Official Website of the Directorate of KSKK Madrasah (Direktorat KSKK Madrasah, 2021).

Of course, this data has not satisfied all parties, especially the educational institution itself. This is a benchmark for the success of schools, especially teachers in learning their students in the field of science. Furthermore, data obtained from the official PISA website explained that the PISA 2025 competency will focus on science and include new assessments of foreign languages. It will also include the innovative domain of learning in the Digital World, which aims to measure students' ability to engage in self-paced learning while using digital tools (OECD, 2024)

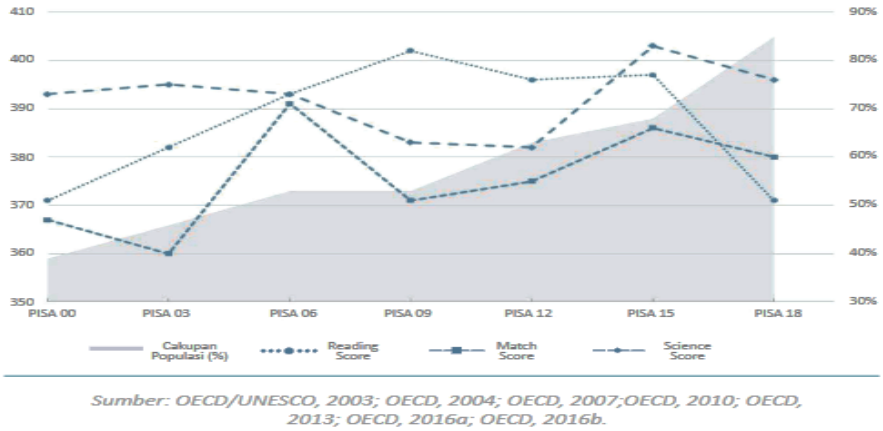

Figure 1. Indonesian PISA Score Trends from 2000 to 2018
(Balitbang Kemendikbud, 2019, p. 5)

Graph 1. The above shows the downward trend of science scores from 2015 to 2018. The results of the PISA assessment in 2019 have also not given encouraging results in terms of the success of learning achievement at the primary and secondary education levels. This is shown from the following data:

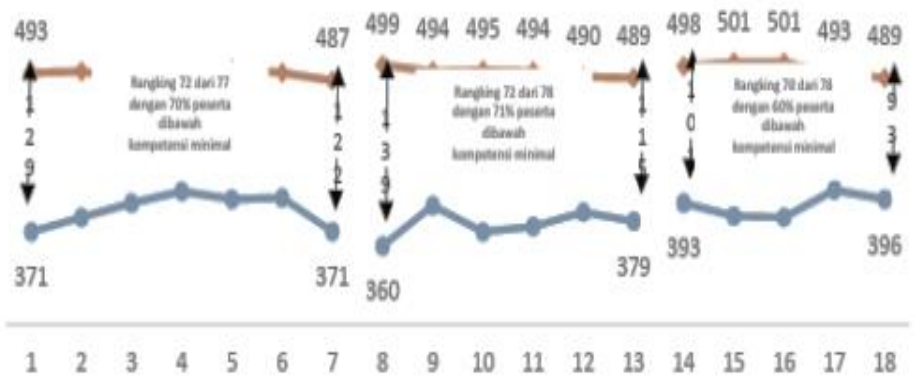

Figure 2. Trends in the Value and Rating of PISA Indonesia (OECD, 2019)

Based on graph 2. above, Indonesia is ranked low, especially for the field of mathematics. Indonesia is ranked 72nd out of 78 countries participating in PISA. More miserable for science and reading results, showing no improvement in grades for 18 years (Kemendikbudristek, 2021, p. 14). TIMSS data also shows that Indonesia is ranked 397th in the world in the field of science class IV of basic education (Reynolds et al., 2021).

Figure 3. Achievements in the Field of Science at the International Level

The data above provides accurate information to us that improvements are needed in the science education process from basic education to higher education. With the acquisition of KSM scores in Central Java Province, of course, the Madrasah Ibtidaiyah Teacher Education Study Program of the Mamba'ul 'Ulum Islamic Institute of Surakarta needs to take part and take responsibility for this problem. IIMU Surakarta is one of the supply campuses for prospective primary education teachers. Therefore, the researcher wants to explore more deeply the readiness of the candidates for basic education teachers at IIMU Surakarta in science literacy. The results of this study are expected to be additional information to improve learning, especially in the stimulus of science literacy.

Methods

Researchers used the quantitative method of *cross-sectional* surveys to collect research data (Creswell, 2015, p. 752). The research respondents were PGMI students in the sixth semester of the Mamba'ul 'Ulum Islamic Institute of Surakarta with a total of 16 respondents. Data were collected using questionnaires (Sugiyono, 2023, p. 234) to measure the science literacy ability of respondents as prospective MI teachers. Data analysis techniques using descriptive statistics (Sugiyono, 2023, p. 59)

Result

The change in the curriculum structure is based on four main considerations, namely (1) changes in subject status, (2) strengthening the authority of education units and educators to develop operational curricula, (3) dividing the curriculum structure into two, namely intracurricular and (4) the project to strengthen the Pancasila student profile, and the existence of elective subjects. Especially at the basic education level, the emphasis is on strengthening numeracy literacy and inquiry thinking skills by integrating natural sciences and social sciences, and English learning is highly recommended to be taught.

In this research, the researcher focused on two aspects that were confirmed to 16 respondents, namely the essence of science and how to learn science. A deeper description of this aspect is discussed as follows:

1. **Truth Natural science**

   The essence of science can be divided into three aspects, namely a way of thinking, a way of investigating, and a Body of Knowledge (Collette & Chiappetta, 1994). Therefore, these three things must be mastered by prospective teachers. However, at the time of confirmation, for the first indicator, namely a way of thinking, only three respondents

(18.75%) out of 16 respondents could explain the concept of science, the three prospective teachers could explain the meaning of science and its scope. When they are able to explain the meaning of science, it means that almost 19% of prospective MI teachers have the curiosity and confidence to argue about the meaning of science. While 13 respondents (more than 80%) did not respond, there were even respondents who stated that they did not like science, while they were in science class, which was an elective course they took.

The second indicator is a way of investigating which consists of how information is obtained, tested, and validated. In this second indicator, there are four respondents or 25% who can explain how simple investigations can be carried out in accordance with the subject themes at the MI/SD/Equivalent level. However, there are still 75% of respondents who do not respond positively to this second question.

The third indicator, the Body of Knowledge consists of Facts, Concepts, Principles and Laws, Theories, and Models. In this indicator, four respondents (25%) can describe well the facts of science in the surrounding environment as well as some science issues that can be taught in the classroom, but there are still mistakes when they explain the concepts, principles, laws, theories, and models of the issues. To clarify the data acquisition in the first aspect, it is presented in the form of a graph below:

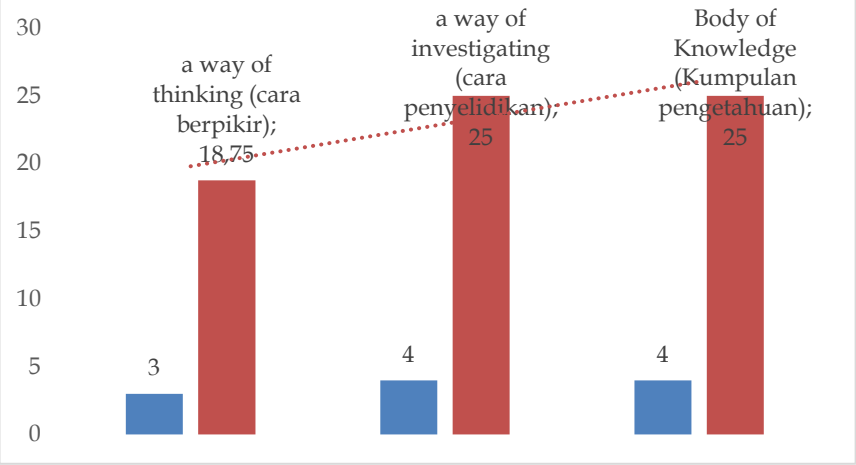

Figure 4. The Ability of MI Teacher Candidates to Explain the Nature of Science

From Figure 4 above, of course, it is felt that there is still a need for a lot of improvement in learning for prospective MI teachers about the Nature of Science, so that they have three aspects, namely a way of thinking, a way of investigating, and a Body of Knowledge.

1.1. How to Learn Science

This second aspect is how to learn science at the basic education level, especially in MI. An overview of information about this second aspect is visualized through Graph 5. below:

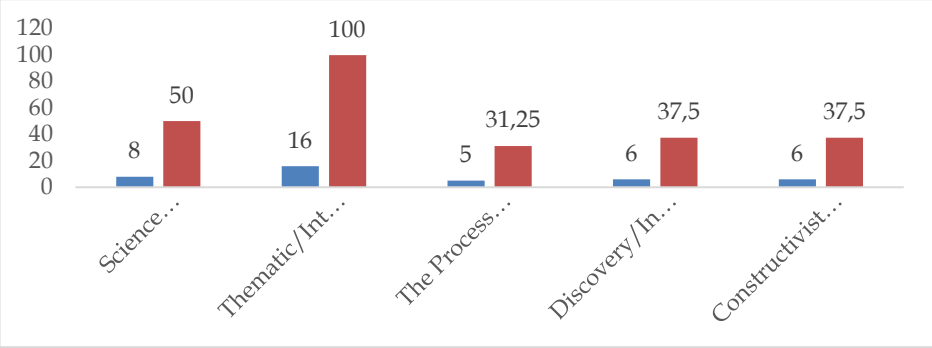

Figure 5. Aspects of How to Learn Science

Based on Graph 5. Above to prospective MI teachers, they were given a choice of ways to learn science in the classroom, from their answers obtained 50% of respondents chose to use the science learning cycle, 100% of respondents chose a thematic/integrated approach to learning science at MI, more than 30% chose a process approach, and almost 38% of respondents chose a discovery/inquiry and constructivist approach in learning science at the MI level. However, respondents were still confused when asked to validate their data. So, it can be said that respondents understand the importance of choosing the appropriate learning model to learn science at the basic education level so that the science learning objectives are more meaningful.

Discussion

The low knowledge of prospective MI teachers about science is a problem that must be immediately followed up by the PGMI IIMU Surakarta Study Program. The selection of courses needs to be studied based on the interest of prospective science teachers. To ensure that prospective teachers who choose science classes seriously become scientists at the MI level, they must master the science material well. They also need to be equipped with information about the results of AKSI, AKMI and even PISA, especially for science literacy.

Prospective science teachers at MI need to understand the competencies expected from science literacy, namely (1) research competence, (2) evaluating and using scientific information for (3) decision-making (OECD, 2019). So, that the problem of science literacy acquisition in Central Java Province can be solved.

When associated with teacher competence, namely pedagogic, personality, social, and professional competencies (Republik Indonesia, 2005) Therefore, the professionalism competence of prospective MI teachers is relatively weak. These professional competencies include (1) mastery of materials, concepts, structures, and scientific mindsets that can support mastered learning; (2) mastery of the learning outcomes of each subject or field mastered; (3) Developing learning materials that are mastered creatively; (4) Carry out continuous professional development by taking reflective actions, and (5) use technology in communicating and conducting self-development (Peraturan Permendiknas, 2007).

Mastery of material, concepts, structures, and scientific mindsets are the first things that are required for a teacher to be said to be a professional in his field of knowledge. If this first condition is not met, it will certainly become a serious problem in learning. Because teaching and learning activities at the basic education level, teachers are the main source of knowledge for students. Students idolize the teacher even more. However, if the teacher is stammering in delivering the subject matter, unable to answer or discuss with students, then the students are also not so sympathetic to the teacher.

This problem is a classic problem found in every science lesson, as a comparison is the finding Indrawati & Nurpatri (2022) which revealed that only 30% of integrated science teachers mastered their teaching materials. One of the reasons was that science had not been taught as it should (Sari, 2013). Ideally, in studying science, prospective teachers as students must be directly involved; their five senses experience what is observed and felt (R. Sari et al., 2017).

Second, teachers must also master the learning outcomes of the subjects they teach, in this case, the achievements of science subjects. So, it is very inappropriate when science teachers do not understand the learning outcomes of their field of study. When teachers misunderstand learning outcomes, the result is that educational goals are not achieved.

The best learning is practical learning because there are hands-on activities so that students better understand what the learning objectives are (Munthe, 2013).

The third requirement is that teachers have innovation and creativity in the development of subject matter when resources in schools are inadequate. Thus, it will

minimize students' misconceptions about the lesson so that students can more easily master the material. So an alternative that can be used for this problem is that teachers need to prepare the learning process with fun activities, not necessarily using expensive resources, but for basic education levels such as MI, it can be done with simple resources such as recyclable materials (R. Sari, 2017).

It is also important for teachers to make self-development efforts, either learning independently or being involved in teacher training activities collectively. In this 5.0 era, learning facilities are unlimited, and teachers can learn offline or online with free digital platforms provided by the Ministry of Education and Culture and from other educational institutions. It depends on the teacher's willingness to be involved in it. Confucius, hundreds of years ago, convinced that what i hear, i forget; what i see, i remember, and what i do, i understand (Chin, 2024). Therefore, lifelong learning is a requirement for the success of teachers today and in the future.

The ability to use digital-based technology and communication is increasingly becoming a necessity. Millennial students are also more interested in technology/digital-based learning. Therefore, future science teachers must be able to prepare their students to become members of society who are literate in science, have high-level thinking skills (HOTS), have the motivation to continue learning and become professional workers (R. Sari, 2017).

Therefore, teachers need to master several skills in designing teaching materials, good communication skills, classroom management, and carrying out assessments using simple but interesting applications for students. So, if these five things are owned by prospective MI teachers, it is certain that education will be of higher quality.

Conclusion

The big challenge of low science literacy in Indonesia starts from the selection of courses that are allegedly invalid. There are still prospective science teachers who state that they don't like science. The second challenge is the learning process in the classroom with a variety of courses that should refer to the acquisition of science literacy assessments nationally and the PISA and TIMSS Indonesia rankings. Third, it is necessary to provide more intensive debriefing to these prospective MI teachers regarding professionalism competence.

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