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The Effect of Teachers' Professional and Pedagogical Competencies on Mathematics Learning Outcomes of Students at Madrasah Ibtidaiyah

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CONTENT

ABSTRACT

Background: Competence is the ability or skill of an individual that is still in the form of potential. In the context of education, teacher competence, both professional and pedagogical, plays an important role in influencing student learning outcomes. **Objective:** This study aims to determine whether teachers' professional and pedagogical competencies influence students' mathematics learning outcomes at Madrasah Ibtidaiyah Negeri 02 Lebong. **Method:** The approach used in this study was ex post facto. This study was conducted in 2023 with a sample of 24 students. Data collection was carried out through questionnaires and documentation. Data analysis used normality tests, homogeneity tests, and paired t-tests. **Results:** The results showed that teachers' professional and pedagogical competencies had a significant effect on students' mathematics learning outcomes at Madrasah Ibtidaiyah Negeri 02 Lebong. Conclusion: Teachers' professional and pedagogical competencies play an important role in improving students' mathematics learning outcomes. Therefore, developing teachers' competencies in these two areas is very important for improving the quality of education at Madrasah Ibtidaiyah. **Contribution:** This study is expected to contribute scientifically to the field of education, particularly education at Madrasah Ibtidaiyah, by providing insight into the influence of teachers' professional and pedagogical competencies on student learning outcomes.

KEYWORDS

Professional and pedagogical competence; Teacher; Mathematics learning outcomes; Students

1. INTRODUCTION

Competence is the ability or ability of a person who is still in the form of self-potential (Amaliyah & Rahmat, 2021). Usman explained that the professional competence of teachers is the ability and authority of teachers to carry out their profession with high ability (Araniri, 2018). So, professional competence is the ability possessed by teachers to master learning materials broadly and deeply and to carry out tasks and authority in their profession with high

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ability (Jamin, 2018). The core competencies of teachers' professional competence include (1) mastering the material; (2) structure; (3) scientific concepts and mindsets that support the subjects taught; (4) mastering the competency standards and basic competencies of the subjects or development fields taught; (5) developing learning materials that are taught creatively; (6) developing professional competence on an ongoing basis by taking reflective action; (7) utilizing information and communication technology to communicate and develop themselves (Utiarahman, 2020). Teachers must know and be able to apply innovative and fun learning models and methods (Siregar et al., 2017). Current education requires students to actively participate in the learning process (Sulistiyawati et al., 2021). Currently, there are many innovative learning models and methods that can make students play an active role, pay attention, and concentrate on participating in the teaching and learning process.

In addition to professional competence, one of the competencies that must also be improved by teachers is pedagogical competence (Nurdianti, 2017). Pedagogical competence is the ability to manage student learning which includes understanding students, designing and implementing learning, evaluating learning outcomes, and developping students to actualize their various potentials (Setiyowati & Winaryati, 2017). Pedagogic competence is the teacher's ability to manage student learning which at least includes understanding educational insights or foundations, understanding students, developing curriculum/syllabus, designing learning, implementing educational and dialogical learning, utilizing learning technology, evaluating learning outcomes, and developing students to actualize their various potentials (Dwintari, 2017).

Pedagogical competence requires teachers to have a set of knowledge, skills, and behaviors that must be owned, lived, and mastered by teachers to be able to carry out their professional duties by directing students (Darmiatun & Nurhafizah, 2019). This competency is an effort to improve the quality of learning, and various efforts are made, namely by increasing learning motivation (Lince, 2022). In terms of learning, students will succeed if within themselves there is a willingness to learn and a desire or urge to learn, because by increasing learning motivation, students will be moved, directed student attitudes and behavior in learning to improve student learning outcomes (Sobandi, 2017).

Mathematics subjects require teachers to actively involve students in learning subjects. A strategy that is often used to activate students is by involving students in class discussions (Fardani et al., 2021). However, sometimes this discussion is less effective even though the teacher has tried to encourage students to actively participate in the discussion process. Many teachers complain that learning outcomes with discussions are not what they expected. Instead of utilizing the activity to improve their knowledge and skills, students play, joke, and so on. To create personal interaction between students, and interaction between teachers and students, the classroom atmosphere needs to be planned in such a way that students get the opportunity to interact with each other. Teachers need to create a learning atmosphere that allows students to work together (Mahardi et al., 2019).

The general purpose of learning mathematics at the primary and secondary education levels is to emphasize the structuring of reasoning and the formation of student attitudes (Amelia et al., 2016). One of the core competencies of learning mathematics is (1) Showing a logical, critical, analytical, consistent, and thorough attitude, being responsible, responsive, and not easily giving up in solving problems; (2) Having curiosity, confidence, and interest in mathematics and having confidence in the power and usefulness of mathematics formed through learning experiences; (3) Having an open, polite, objective attitude, respecting the opinions and work of friends in group interactions and daily activities. So the ability to reason (logical thinking) and creative thinking is very useful for students in the learning process.

Based on the results of preliminary interviews with one of the mathematics teachers at MIN 02 Lebong, it was revealed that the mathematics teachers in the madrasah have shown their abilities or competencies both professional competence and pedagogical competence. The professional competence of mathematics teachers at MIN 02 Lebong is characterized by having mastered the competency standards and basic competencies as well as the mathematics subject matter they teach. The pedagogical competence of mathematics teachers at MIN 02 Lebong is characterized by the ability to manage the curriculum or syllabus which includes the purpose, content, process, resources, and means of evaluation for all learning experiences planned for students.

The results of the researcher's initial observations when observing one of the math teachers who was teaching math lessons also showed that the teacher had not used learning media, the teacher only applied the lecture method in the learning process by looking at the textbook. In teaching math material, the teacher only gives oral explanations while students only observe in their respective seats. For this reason, researchers observed that during the learning process, there were still students who did not pay attention properly and listened to the teacher's explanation. Researchers observed that most of the students were less enthusiastic about participating in the learning process, some students were busy chatting with their friends in whispers, some students looked dreamily while scribbling

on books, some students looked sleepy, only a few students paid attention to the teacher's explanation in front of the class.

The purpose of this study is to determine the effect of the professional and pedagogical competence of teachers on student learning outcomes in Madrasah Ibtidaiyah Negeri 02 Lebong. The focus of the research examines whether or not there is an influence of professional competence and pedagogical competence of teachers on student learning outcomes in mathematics at school.

2. METHOD

2.1 Research Design

The research approach uses ex post facto, which is research conducted where the data collected in this study comes from existing data so that the research uses ex post facto research methods. The data in question are the scores of the Midterm Test (UTS) of fifth grade MIN 02 Lebong students in mathematics subjects in the Odd and Even Semesters of the 2020-2021 school year. Ex post facto research according to Sugiyono is research conducted to examine events that have occurred and then look back to find out the factors that can cause these events. It is said to be correlation research because this research is conducted when you want to know about the strong or weak relationship between two or more variables.

2.2 Research Object

This research was conducted at MIN 02 Lebong in 2023. The population in this study was all four and six students totaling 116 students. The sample in this study was set to be 40% of the population, so the sample was 24 students. Sampling using purposive sampling technique.

2.3 Data Collection

Data collection consist of (1) Questionnaire. Researchers used a questionnaire in the form of a Likert scale with closed statements, namely the answers to the statements submitted were provided; (2) Documentation. Researchers used documentation in the form of data needed by researchers during the data collection process.

2.4 Data Validity Checking

To check the validity of the data that has been collected, researchers use validity and reliability tests (1) Validity Test. Researchers used the validity test to determine whether the questionnaire to be used in the study was valid or not. The technique used to measure the validity of the question is the product-moment correlation technique. The validity test results show that of the 30 items (questionnaire) there are 23 valid items and there are 7 invalid items; (2) Reliability Test. Researchers used a reliability test to determine the level of reliability of the research instruments used. Testing using the product moment formula, to measure the level of instrument reliability can be done with Spearman Brown's split-half technique. The reliability results show that the "df" value of 27 at a significant level of 5% is 0.381 and for that at a significant level of 1%, the value is 0.87. This means that the item (questionnaire) has high reliability.

2.5 Data Analysis

In the data analysis process, data testing uses the following analysis: (1) Data Normality Test. The normality test is carried out to measure whether the data has a normally distributed population or not. In this study, the normality test used the SPSS Kolmogorov-Smirnov Test; (2) Data Homogeneity Test. The data homogeneity test is carried out to determine whether the variation of some data from the population has the same variance or not; 93) Data Hypothesis Test (T-Test). Research hypothesis testing was carried out using the paired t-test, researchers used the t-test to determine whether there was a statistically significant difference between the means of two variables.

3. RESULT AND DISCUSSION

3.1 Result

3.1.1 Normality Test Results

The normality test is carried out, namely (1) If the significant value (Sig) > 0.05 then the research data is normally distributed; and (2) If the significant value (Sig) < 0.05 then the research data is not normally distributed. The results of the normality test are described in the table below:

Table 1. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardiz ed Residual
N		24
Normal Parameters[a]	Mean	.0000000
	Std. Deviation	2.20791219
Most Extreme Differences	Absolute	.094
	Positive	.060
	Negative	-.094
Kolmogorov-Smirnov Z		.462
Asymp. Sig. (2-tailed)		.983

a. Test distribution is Normal.

The normality test results show that the significance value of Asymp.Sig. (2-tailed) of 0.983> 0.05. So by the basis for decision making in the Kolmogorov Smirnov normality test above, it can be concluded that the data from the population is normally distributed.

3.1.2 Homogeneity test

Normality test is carried out provisions, namely (1) If the significant value (Sig) > 0.05 then it is said that the data is homogeneous; and (2) If the significant value (Sig) < 0.05 then it is said that the data is not homogeneous. The homogeneity test results are described in the table below:

Table 2. Homogeneity Test Results

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.552	2	69	.579

The normality test results show that the significant probability value (sig) is 0.579 > 0.05. This means that all variables are homogeneous or the same.

3.1.3 Hypothesis Test Results

Hypothesis testing using paired t-test, t-test is conducted to determine the effect of independent variables partially on the dependent variable, whether the effect is significant or not. The results of the hypothesis test are described in the following table:

Table 3. Hypothesis Testing

Coefficients[a]

Model		t	Sig.
1	(Constant)	2.675	.014
	X1	2.720	.013
	X2	.436	.047

The results of hypothesis testing resulted in a significance value (sig) of 0.013. This means that the significance value (sig) (0.013) < (α) 0.05, it can be concluded that H1 means that the teacher's professional competence affects students' math learning outcomes. While the significance value (sig) is 0.047. This means that with the significance value (sig) (0.047) < (α) 0.05, it can be concluded that H2 means that the teacher's pedagogical competence affects student learning outcomes in mathematics.

3.2. Discussion

This study was conducted to determine whether or not there is an effect of teachers' professional competence on students' math learning outcomes at MIN 02 Lebong and to determine whether or not there is an effect of teachers' pedagogical competence on students' math learning outcomes at MIN 02 Lebong. The results of this study are the results of the first regression known significance value (sig) is 0.013 which means the significance value (sig)

(0.013) < (α) 0.05. This means that there is an effect of teacher professional competence on student math learning outcomes at MIN 02 Lebong. As well as the results of the second regression known significance value (sig) is 0.047 which means the significance value (sig) (0.047) < (α) 0.05. This means that there is an influence of teachers' pedagogical competence on students' math learning outcomes at MIN 02 Lebong.

Teachers are an important factor in the implementation of the learning process (Lawrence & Tar, 2018). Sagala expresses briefly that teachers are people who provide knowledge to students. Sagala also added that teachers are all people who are authorized and responsible for the education of students, both individually and classically, both at school and outside school (Yunus et al., 2021). Teachers must be able to maintain the public trust given to them. Teachers must be able to maintain the public trust given to them (Bukko et al., 2021).

Professional educators with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating students in early childhood education in formal education, primary education, and secondary education (Bakar, 2018). Teacher is a position or profession that requires special expertise as a teacher (Hordern, 2015). This job cannot be done by people who do not have the expertise to carry out activities or work as a teacher. People who are good at speaking in certain fields cannot be called teachers. To become a teacher, special requirements are needed, especially as a professional teacher who must master the intricacies of education and teaching with various other sciences that need to be fostered and developed through a certain period of education or pre-service education (Council, 2016).

Competent teachers will be better able to create a conducive, effective learning environment and can manage their classes well so that student learning outcomes are optimal (Sudargini & Purwanto, 2020). One of the roles of the teacher in the teaching and learning process is the teacher's role as a classroom manager (Oratmangun, 2021). Teachers should be able to manage the classroom as a learning environment (Priya et al., 2016). The general purpose of classroom management is to provide and use facilities for various learning and teaching activities to achieve good results (Bizimana & Orodho, 2014). The specific objectives of classroom management are to develop students' ability to use learning media, provide classroom conditions conducive to learning, and help students obtain good learning outcomes (Berlian, 2022).

Professional competence is the ability to master learning materials broadly and deeply which allows teachers to guide students to master knowledge or skills optimally, to meet the competency standards set out in the National Education Standards (Prasetyono et al., 2021). Professional competence is a set of abilities that a teacher must have to carry out his teaching duties successfully (Asmarani et al., 2021). Professional competence is one of the competencies that must be possessed by teachers in carrying out the duties of their teaching profession (Murkatik et al., 2020).

In particular, pedagogical competence is the ability to manage student learning which includes understanding students, designing, implementing learning, and evaluating learning outcomes. Meanwhile, according to Hoogvel, pedagogics is a science that studies the problem of guiding children towards certain goals, namely so that children will be able to independently complete their life tasks.

4. IMPLICATIONS AND CONTRIBUTIONS

4.1 Reseach Implication

The implications of the results of this study are expected to be useful and can provide scientific contributions in the field of education, especially education in Madrasah Ibtidaiyah, namely contributing knowledge about the influence of teachers' professional and pedagogical competencies on student learning outcomes in Madrasah Ibtidaiyah Negeri 02 Lebong.

4.2 Reseach Contribution

This study provides insight into the influence of teachers' professional and pedagogical competencies on students' mathematics learning outcomes in Madrasah Ibtidaiyah. The findings indicate that both competencies play an important role in enhancing the quality of learning and academic outcomes, and can serve as a basis for developing educational policies aimed at improving teacher competencies.

5. LIMITATIONS AND RECOMMENDATIONS

5.1 Limitation

This study has several limitations: (1) In ex-post facto studies, researchers cannot modify independent variables; (2) Random allocation of subjects to various groups is not possible; (3) Researchers may face difficulties in fully explaining the relationship between the independent and dependent variables studied.

5.2 Recommendations

Based on these limitations, it is recommended that future research uses control variables on independent variables. Additionally, the results of this study should be considered by teachers and schools in understanding the influence of teachers' professional and pedagogical competencies on students' mathematics learning outcomes.

6. CONCLUSION

To improve student learning outcomes in mathematics, the role of the principal is crucial in ensuring that continuous evaluations of teachers' competencies, especially their professional and pedagogical skills, are carried out regularly. A principal's responsibility includes monitoring teachers' performance, identifying areas of improvement, and providing necessary support or professional development programs. By doing so, the educational institution will be better aligned with the needs and expectations of students' parents, who seek high-quality education that fosters the academic and personal growth of their children. Moreover, such evaluations help ensure that the teaching methods and content remain relevant and effective, ultimately contributing to the overall progress of students.

Teachers must also focus on improving their pedagogical competence, particularly in the area of educational insight or foundation. Understanding the educational foundations is essential for any teacher, as it serves as the basis for all their instructional practices. A teacher who possesses a strong grasp of educational principles is better equipped to implement the curriculum effectively, align their teaching strategies with learning objectives, and adapt to the diverse needs of students. This foundational knowledge allows teachers to recognize the broader purpose of education, which goes beyond the mere transmission of knowledge to students. By acknowledging the real function of schools, teachers can create a more enriching and supportive learning environment that benefits both students and the community.

Additionally, a teacher's ability to understand students psychologically is an integral component of their pedagogical competence. When teachers are aware of the emotional and developmental stages that students go through, they can tailor their teaching methods to be more engaging and sensitive to students' needs. This competency enables teachers to recognize individual differences, provide personalized learning experiences, and build stronger relationships with students. Teachers who exemplify positive social values and serve as role models can significantly impact students' character development. By fostering an environment where students feel understood, respected, and motivated, teachers can help students achieve not only academic success but also personal growth, preparing them for life beyond school.

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Author Contribution Statement

All authors discussed the results, contributed to the final manuscript, and approved the final version for publication. APY: Conceptualization, Methodology, Writing - Original Draft; AA: Conceptualization, Writing - Review & Editing.

Conflict of Interest Statement

The authors declared that they have no competing interests with respect to the research, authorship, and/or publication that might have influenced the performance or presentation of the work described in this article.

Ethical Approval Statement

The authors declare that this study was conducted with due regard for research ethics, including obtaining approval from the institution. This includes respecting the autonomy of participants, maintaining confidentiality of data, and ensuring their safety and well-being, in accordance with applicable research ethics guidelines.

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