



Utilization of Merdeka Mengajar Platform by Productive Mathematics Teachers : Impacts, Motivations, and Strategies

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Abstract: This study aims to analyze the impact, motivation, and strategy of using the Merdeka Mengajar platform by productive mathematics teachers. This study used mixed-method with case studies in its qualitative research and quasi-experiments in its quantitative research. The participants of the case study were 15 productive mathematics teachers, and the sample of the quasi-experiment was one of the classes taught by the teacher. Quantitative data were obtained from students' learning outcomes, and qualitative data from semi-structured teacher interviews. The quantitative analyses used were descriptive statistics and inferential statistics. The qualitative analysis refers to three steps: data condensation, data display, and decision-making. The results showed that the impact obtained by mathematics teachers was an enhancement in competence and knowledge, including those related to teaching and technology. Learning innovations inspired by learning outcomes in PMM were effectively implemented in the mathematics classroom. What motivates teachers to optimize the use of PMM varies from the desire to continue learning and provide the best quality of learning to the desire to contribute to student success and to be role models. There are three elements in productive mathematics teachers' strategies to optimize the use of PMM in self-development. They are targets, consistency, notes and implementation with feedback, and self-reward as a supporting element.

Article History

Received: 04-09-2023
Revised: 22-10-2023
Accepted: 14-11-2023
Published: 16-12-2023

Key Words:

Merdeka Mengajar
Platform; Mathematics
Teacher; Impacts;
Motivations; Strategies.

How to Cite: Ikram, F., Anaguna, N., & Rosidah, R. (2023). Utilization of Merdeka Mengajar Platform by Productive Mathematics Teachers : Impacts, Motivations, and Strategies. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 9(4), 1195-1205. doi:<https://doi.org/10.33394/jk.v9i4.8936>



<https://doi.org/10.33394/jk.v9i4.8936>

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Introduction

Mathematics is one of the most important subjects because of its wide application. Mathematics, as part of STEM (Science, Technology, Engineering, and Mathematics), can aid students in cultivating the skills needed for life and careers (Maass & Engeln, 2019). However, many students in Indonesia think that mathematics is a complex subject to comprehend and that mathematics lessons are often dull due to the lack of innovation to provide quality learning (A & Sihotang, 2021). Thus, one of the things that needs attention is the development of the mathematics teachers' professionalism.

The role of teachers is essential in the world of education. Teachers contribute to preparing students to face increasingly large and complex challenges as the times develop (Mamoh & Bete, 2019). In addition, teachers play an essential role in providing better education and quality learning to students (El-ahwal, 2020; Fadhliyah et al., 2020; Fatmawati & Utama, 2023; König et al., 2021; Nelly et al., 2022; Suryawati et al., 2021). It is supported



by (Sheveleva et al., 2021) survey of 600 teachers, which shows that teacher professionalism is one of the most critical factors affecting the quality of education.

Mathematics teachers encounter numerous challenges in delivering quality mathematics learning. They must adapt to changing standards and expectations for learning mathematics and statistics today (Hollebrands & Lee, 2020). These changes have become even more pronounced following the pandemic. Teachers' problems include a lack of pedagogical and professional competence (Utami et al., 2021) and limited resources to support their professional development (Hollebrands & Lee, 2020).

Professional development through self-development is one of the tasks that teachers must do (Safruddin et al., 2020). The purpose of the task is to prepare the teacher to become competent in the learning process (Nuryanti et al., 2022). It is a task that must be done to optimize the quality of education and learning (Ambarwati, 2019; Kartomo & Slameto, 2016; Nuryanti et al., 2022). The self-development activities can include training, workshops, courses, and so on (Jawahir & Yusuf, 2021; Kartomo & Slameto, 2016).

Various digital platforms have emerged throughout the pandemic to assist teachers' self-development. More teachers are turning to platforms that provide online self-development activities (Hollebrands & Lee, 2020). These platforms greatly influence teaching quality as teachers interact with various resources in planning and developing their competencies and learning (Lei & Medwell, 2021; Pepin et al., 2017). In this case, the Indonesian government also did not remain silent and launched various digital self-development platforms teachers can utilize to develop their competencies.

One of the platforms that can aid teachers in developing their professionalism is the Merdeka Mengajar Platform (PMM). It facilitates the government, teachers, and education practitioners to collaborate and share their ideas (Jawahir & Yusuf, 2021). PMM can help teachers design and implement innovative learning (Setyawan & Syamsuryawati, 2023). By providing such a platform, the government hopes that teachers can provide students with the best quality of education. PMM is also an effort to improve teacher professionalism continuously (Ni Putu et al., 2023). Therefore, this application benefits teachers, especially those who want self-development to develop their competence.

Although the government has launched many self-development platforms, including PMM, there is still a lack of supporting information (Jawahir & Yusuf, 2021). Research by Jawahir & Yusuf (2021) discussed Guru Belajar and Guru Berbagi (now called PMM) and how teachers respond to their self-development using these two applications. The study only addressed in general terms the programs followed, benefits, reasons for use, and difficulties encountered. Their research did not discuss further and in detail the benefits obtained and the effectiveness of the innovations brought into the classroom. There was a study conducted by Budiarti (2022) that investigated how mathematics teachers utilized PMM. However, the study did not specify the benefits obtained, especially regarding the learning innovations' details. In addition, they only explained the benefits qualitatively and did not prove it empirically. Data related to the impact of PMM on mathematics teachers and learning requires both quantitative and qualitative data.

Another problem that arose was the minimal use of PMM. This research's preliminary survey showed that out of 55 mathematics teachers, only 14 use them regularly. Data from gurubelajardanberbagi.kemdikbud.go.id supports this lack of use. Calculated since 2 September 2023 from the website, there are a total of 1,406,085 users. However, posts related to lesson plans and articles were only 671,644 and 14,082, respectively. The video posts were only 190, and the number of action posts was only 1439.



The results of this study's preliminary survey also revealed that many mathematics teachers found it challenging to complete the training or view and listen to the works of teachers on PMM due to several reasons, including lack of time due to many other matters to be completed, an environment that is also lazy to do self-development if superiors do not require it, and lack of will and initiative. Similarly, Jawahir & Yusuf (2021) suggested that a lack of willingness and support from the environment hinders the optimal use of PMM. Fadhliyah et al. (2020) added that one of the difficulties found when teachers access PMM is related to limited time.

The reasons that prevent mathematics teachers from maximizing PMM for self-development and learning contradict the fact that there are productive mathematics teachers who can maximize PMM to improve their competencies and teaching quality. The main tasks of teachers are to develop themselves and become agents of change that can significantly impact the quality of education and learning. Therefore, teachers should continue to improve by learning and developing themselves, and if necessary, learn from productive mathematics teachers in self-development.

Based on the problems and the explanation described, Researchers consider it essential to know the benefits obtained by productive mathematics teachers in using PMM, what motivates them, and what strategies they use to optimize the use of the platform. Information related to these aspects is essential because governments or schools could use them as a reference in developing and optimizing PMM further to facilitate and assist teachers in developing their competence. In addition, the results of this study can make less productive teachers more interested and motivated to use PMM because they can find out the benefits that can be obtained, see empirical evidence of the implementation of things that have been learned in PMM, and know the motivations and strategies behind optimizing the use of the platform.

In addition to the problems previously described, researchers consider it necessary to discuss topics related to the use of PMM because it was the recommended research topic suggested by (Clark-Wilson et al., 2020), which is associated with the impact of long-term use of technology by teachers in mathematics classrooms. Clark-Wilson et al. (2020) suggested that teachers often comment that the self-development undertaken has little relevance to their classroom experience. Wilson continues that they ask for practical resources that can be applied easily.

Research Method

This mixed-method research used a convergent design. This design is used when the researcher simultaneously collects quantitative and qualitative data (Creswell & Clark, 2018). In the quantitative research of this study, researchers used quasi-experiments to test whether the learning inspiration obtained from PMM is effective in the classroom. As for the qualitative research, this research employed a case study by conducting interviews to obtain data related to the utilization of PMM from productive mathematics teachers' perspectives. This research used a case study because it focuses on providing an in-depth understanding of a case (Creswell & Poth, 2018). The case in this study was the utilization of PMM by productive mathematics teachers, which consists of impacts, motivations, and strategies.

The respondents of the qualitative study were 15 mathematics teachers categorized as productive teachers. The chosen participants were productive mathematics teachers who often conducted daily self-development activities using PMM. As for the quantitative part, the sample taken was one class taught by one of the participants (coded as PT) using strategies inspired by the Merdeka Mengajar Platform. PT's class was chosen because PT was willing to



provide data related to the learning that PT has carried out, such as learning outcomes and screenshots of assignments or Google Classroom.

The instruments in this study were divided into the main and supporting instruments. The main instruments were the researchers, and the supporting instrument was the interview guide. This guide contains some questions that the researchers will ask. The questions asked were about the impacts of using PMM, motivation, and strategies to optimize platform use. The learning has been carried out in quantitative research, and the test score data already exists.

This study collected quantitative data by collecting mathematics test results from the teacher (PT). PT used Google Forms to give their tests. The material assessed was statistics. Students had to score above 76 to pass the exam at the school. This research used SPSS (Statistical Product and Service Solutions) to analyze quantitative data. There were two criteria for effectiveness. Firstly, the average score of each class must be higher than 76. Secondly, the percentage of students passing the minimum criteria must be more than 85%. This study used the mean score to determine the average mathematics score of each class. This research also calculated the number and percentage of students who passed and did not pass the criteria of 76 (KKM or Minimum Passing Criteria).

Before conducting the t-test, researchers had to check whether the data obtained followed a normal distribution. In this case, researchers used the Shapiro's Wilk test. The criteria of the test were if $p > 0.05$ the data follows the normal distribution. However, if $p \leq 0.05$ then the data is not normally distributed. If the data follows normal distribution, then a one-sample t-test is used to determine whether the mean score of each class is significantly higher than 76. The hypothesis is:

$$H_0 = \mu_p \leq 76 \text{ vs } H_1 = \mu_p > 76$$

μ_p is the average score parameter of the mathematics test results. The null hypothesis (H_0) means that the score is lower than or equal to 76, while the alternative hypothesis (H_1) indicates that the mathematics test results are higher than 76. The decision to reject H_0 is taken when the t value is more than zero, and the significance value is less than 0.05. However, if the data does not follow the normal distribution, researchers employed a one-sample Wilcoxon signed rank test.

Regarding qualitative data collection, this study used interviews. This research conducted the interviews by first enquiring about the documentation of the interviews, either transcribed live, audio-recorded, or video-recorded. The interviews used in this study were semi-structured. The interview guidelines did not thoroughly guide the interviews as a supporting instrument. Questions may change based on the responses given by the participants.

The data analysis used in this qualitative research follows three main steps: data condensation, data display or presentation, and decision-making (Miles et al., 2020). In data condensation, this study filters the data by determining which data should be the main focus. However, this research did not discard data that was not the main focus. Researchers keep the data for comparison purposes at a later time because it may be used again when the temporary conclusions obtained are inadequate. In this step, researchers organized and categorized the responses the mathematics teachers gave based on the utilization of PMM, which are the impacts, motivations, and strategies to optimize it. In data display, researchers displayed data in the form of transcripts, tables, or pictures to compare the responses given by the mathematics teachers. Based on the results of the comparison, researchers then made conclusions. The conclusions obtained may be provisional. In this case, researchers will re-

examine the data that is not the main focus or consider collecting more. In this study, data validity was achieved using triangulation. Triangulation is used to validate research findings (Creswell, 2019). Data triangulation was used by comparing interview results from different research respondents. By comparing data from several respondents, more credible data can be obtained.

Results and Discussion

Impacts

The results of this research interview showed that productive mathematics teachers perceived many benefits that had been gained from using PMM. Fifteen teachers mentioned the improved competence as a teacher (100%). Ten participants also stated that there was an improvement in the ability to use technology (67%). Lastly, three productive mathematics teachers said their students' learning activities and outcomes improved (20%). Concerning improving competence as a teacher, the productive mathematics teachers revealed that through PMM, they learned how to design and deliver quality learning. Through the high frequency of PMM utilization, they know how to use technology to assist their teaching.

The benefits obtained by the teachers are similar to those suggested by (Tuan et al., 2017) that a combination of online and offline professional development training can improve teachers' teaching knowledge. The other benefit of using PMM is that teachers are more proficient in using various platforms or applications in teaching mathematics. It is similar to the findings explained by Thurm & Barzel (2020), which were the frequency of technology use in mathematics learning increased during the professional development program. The considerable use of technology by productive mathematics teachers is supported by the opinion (Tabach & Trgalová, 2019) that technology significantly impacts teacher practice and facilitates new approaches to learning and teaching.

Researchers then asked for an example of learning that had been implemented in the classroom and was inspired by the learning outcomes at PMM. One of the participants, PT, revealed that she designed a lesson inspired by the Market Place Activity (MPA) method, which seems to present the atmosphere of buying and selling transactions in learning. PT explained that she then designed the lesson by modifying the elements in the MPA. In PT's learning, there is the use of a project to make a video explaining the material or discussing the questions that will be delivered in class. During the lesson, the students will take turns giving questions or feedback on the video and then conclude the lesson. The teacher modifies what she has read and seen in PMM to apply in their classroom. It can be inferred that students also benefited from the innovation made by the productive teachers. Researchers then asked permission to look at one of the video submission tasks and one of the video screenshots. These can be seen in the following Figures.

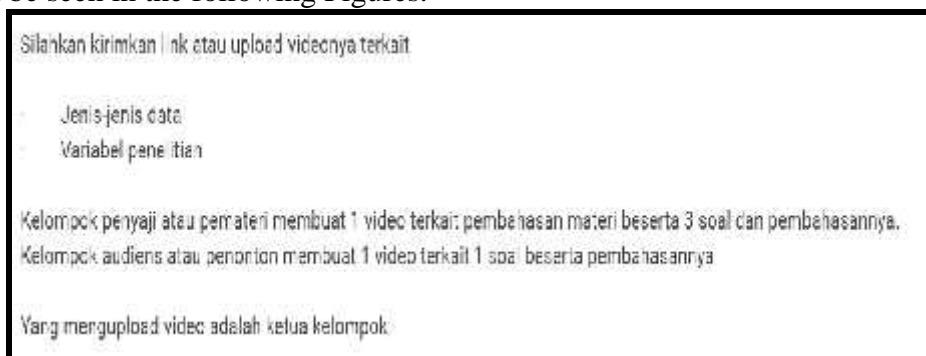


Figure 1. Screenshot of Video Task Explanation of Material or Problem Discussion



Figure 2. Screenshot of One of the Group Work Videos

The interviews and the Figures showed that the mathematics teachers applied what they had learned in PMM. Similarly, it was reported by Jawahir & Yusuf (2021) that many teachers modified and gained ideas for designing lessons to be implemented in their future classrooms after attending PMM.

The impact on students regarding increasing their understanding is certainly not enough if only described qualitatively. Therefore, researchers asked PT for permission to analyze the statistical test scores of students who had been taught using the video to find out whether the learning inspiration obtained from PMM was effective in being applied in the classroom. The results of the descriptive statistical analysis are as follows.

Table 1. Learning Implementation Result

Below Standard	Above the Standard	Mean	Standard Deviation
2	30	89.21	7.43

Thirty students scored above the standard (93.75%). Thus, one of the learning effectiveness requirements set out earlier has been met. The mean of the students' statistics test scores is more than 76, which is 89.21, with a standard deviation of 7.43. Descriptively, the mean is more than 76. However, researchers must check whether the score is significantly more than 76. Therefore, researchers conducted a one-sample t-test to find out. Before the t-test, researchers conducted a normality test as a prerequisite test to determine whether the data obtained followed a normal distribution. The normality test used was the Shapiro-Wilk Test. H_0 Indicates that the data obtained is normally distributed while H_1 indicates that the data obtained is not normally distributed. The criterion for rejecting H_0 is a significance value that is less than 0.05. The results of the test are as follows.

Table 2. Results of Shapiro Wilk Test

Df	Sig.
32	0.164

The table shows a significance value of more than 0.05, meaning H_0 fails to be rejected. It means that the students' statistics test score data is normally distributed. Furthermore, researchers conducted a one-sample t-test, and the results are shown in Table 3 below.

Table 3. Results of One-Sample t-Test

Sig.	t value
0.000	10.06

Based on the criteria explained earlier, the t value of more than 0 (10.06) and the significance value of less than 0.05 indicate that H_0 is rejected. Students' statistics learning outcome scores are significantly more than 76. This research findings add to the evidence that teacher-inspired learning in PMM is effective to be implemented in the classroom. That is, PMM has an impact not only on teachers but also on students. The results of this study are supported by several studies stating that the use of PMM can improve teacher competencies and help the learning process (Aulia et al., 2023; Defa et al., 2023; Marisana et al., 2023; Ramdani et al.,



2022; Suryadi & Hidayati, 2023), including in mathematics learning (Budiarti, 2022). These research findings are also supported by the results of (Susanti et al., 2023; Triscova et al., 2022), who reported that teachers found it helpful in understanding the implementation of the Merdeka curriculum and were highly inspired in designing teaching modules and creative learning content.

Motivations

This research interviews showed that what motivates the productive mathematics teachers to continue to do self-development are: (1) the desire to be a role model to students (67%), (2) the desire to improve competencies (100%), (3) the desire to continue to develop in adapting to the needs of the times (100%), and (4) the desire to provide the best quality of learning (100%). The teachers consider that teaching methods may change, so they must keep updating their knowledge and skills. The materials' quality, completeness, and credibility (80%) also motivate the teachers to use PMM in developing their competence. According to them, only the teacher's willingness determines whether the teacher can optimize PMM. The same thing was stated by Defa et al. (2023) that PMM is an almost complete platform, and all is returned by teachers whether they want to optimize it or not. The desire to develop competence was also found in a study by Jawahir & Yusuf (2021), which motivated teachers to use PMM. The motivations mentioned are things that encourage the participants to maximize PMM. It is something that some teachers in this research's preliminary survey may not have, as many of them rarely do self-development due to other reasons.

Strategies

The teachers' strategy to maximize the utilization of PMM was to focus on several elements. Three crucial elements and one supporting element must be considered to optimize PMM for self-development. The first is the target. Fifteen productive mathematics teachers said that we must set daily or weekly learning targets to have clear goals. The second is consistency. All participants noted that this element is equally important because if this element is not present, laziness will dominate and make us less likely to do self-development. Third is notes and application. Ten mathematics teachers mentioned the need to record the important things they have learned and then modify them to be applied according to the classroom's needs. Finally, two productive teachers said the need to occasionally pay attention to self-reward that grants teachers' wishes to be more motivated in self-development.

These four elements are necessary for maximizing self-development through PMM. Consistency prevents performance decline and can make teachers more productive in developing themselves. A similar thing was stated by Yolanda & Syamsir (2020) that consistency is one of the elements that can significantly affect employee performance. Next, some rewards can maximize performance or self-development and are one of the strategies teachers or educational institutions can use. Mubarok (2021) argues that rewards can stimulate employees to participate in racing to develop their competence.

Implications

These research results have shown the impact, motivations, and strategies of productive mathematics teachers using PMM for self-development. This research supports the idea that online teacher professional development platforms, including PMM, have many benefits that can be gained from maximizing their use. Similarly, Lailatussadah et al. (2020) found that the passing rate for teachers in the online professional development program was above 90%. Moreover, Lei & Medwell (2021) and Pepin et al. (2017) even described that online platforms greatly influence teaching quality. However, these research findings also suggest that strategies are needed to maximize the use of these platforms.



These research findings show that many research topics of PMM use must be investigated, and there are still various things that need to be explored, such as the effectiveness of using PMM on a national scale, developing and adding features to PMM, or even the effectiveness of particular strategies in maximizing PMM. Therefore, various studies related to PMM are still very wide open for researchers to carry out. Information related to the benefits, motivations, and strategies of productive mathematics teachers in utilizing PMM influences the world of education. This information can aid and influence how government and education policymakers optimize teacher professional development, including developing and optimizing existing self-development applications or platforms. The data presented in this study also impacts how universities prepare and design curricula that can optimize the professional development of prospective teacher students in the future.

Conclusion

Based on the results of the research conducted, the following conclusions were obtained.

- 1) The benefits obtained by mathematics teachers are not only learning innovations but also increased competence and knowledge, including those related to learning, teaching, and technology. The students also felt the benefits, as evidenced by the students' scores reaching 89 and the pass percentage exceeding 90%.
- 2) The learning innovation, inspired by PMM in the form of a modified Market Place Activity learning method supported by video project assignments, was effectively implemented in the mathematics classroom.
- 3) What motivates productive mathematics teachers to optimize the use of PMM is the desire to continue learning, develop competencies, and meet and adapt to the needs of the times as teachers. Other motivations are the desire to provide the best quality of learning and the quality of the self-development platform. Another motivation was the desire to be a role model and motivation for the students.
- 4) There are three elements in productive mathematics teachers' strategies to optimize the use of PMM in self-development. They are targets, consistency, notes and implementation with feedback, and self-reward as a supporting element that aims to motivate mathematics teachers in self-development further.

Recommendation

Researchers interested in the topic of PMM could explore involving several mathematics teachers from different levels. Other researchers might consider examining the problems with using PMM in a school and how the school could implement school action research to address these problems. Another possibility is to survey what self-development platforms teachers frequently access and compare them. It can certainly be a reference for the government to continue to improve the quality of PMM.

Acknowledgement

Researchers would like to thank the Directorate of Research, Technology, and Community Service of Indonesia, who have supported us in conducting this research.

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