

# Note on the Professionalism of Mathematics and Science Teachers in The Post-Covid-19 Pandemic

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## Note on the Professionalism of Mathematics and Science Teachers in The Post-Covid-19 Pandemic

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**Abstract:** This study aims to analyze mathematics and science teachers' professional identity and competence during the Covid-19 pandemic. This study used the literature review method with data analysis using the content analysis method. This study used documentation instruments published in nationally accredited journals, indexed proceedings, Scopus-indexed international journals, and teacher's competence books. The results were some of the skills that mathematics and science teachers need this time. Several skills were the experience of implementing learning during the Covid-19 pandemic, including scientific literacy skills, classroom management skills both online and offline, including actively involving students, and communication skills, especially with parents.

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### Introduction

The Covid-19 pandemic has created concerns about various conditions. The community and multiple fields of life will get an impact, especially in education. All aspects of daily life have been paralyzed and transformed into a new civilization. One of them is in the field of education with online learning or distance learning. Lockdown is a common buzzword people have been thinking about during the Covid-19 pandemic. In fact, lockdowns are emergency protocols by relevant authorities (in this case, central and state governments) to prevent people from leaving their residences. They have since led to mass quarantines, and stay-at-home orders worldwide are leading March 2020 (Mishra et al., 2020; Moreno-guerrero et al., 2020). Some face-to-face processes in schools suddenly changed drastically with online learning. Maintaining physical distance is alternative prevention during a pandemic (Almarashdi & Jarrah, 2021; Ariyanti & Santoso, 2020). It takes support from many parties to overcome these difficulties. Always be optimistic and patient, and motivate and strengthen each other to believe everything will recover soon. In education, teachers and students will experience the impact of Covid-19. Through a technology-based online learning system, the government requires educational institutions, teachers, students, and even parents to be technologically proficient. It will trigger the acceleration of the transformation of educational technology in Indonesia. It certainly has a positive impact because technology in education is in line with the Industrial Revolution 4.0 era, which continues to crawl forward.

The current situation is certainly not easy for the world of education. Simultaneously changing online learning patterns to prevent the spread of COVID-19 and break the chain is a new challenge for teachers, parents, and students who are no longer accessible in the learning process (Abidah et al., 2020; Almarashdi & Jarrah, 2021). Online learning is learning delivered through the use of the Internet. Any learning that occurs remotely and outside of a



traditional classroom setting is considered distance learning. Online learning is just one example of this (Ariyanti & Santoso, 2020). The impact on classroom learning is the emergence of online learning applications, free or discounted online courses, unlimited student creativity, a collaboration between parents and teachers, and applying knowledge in the family. Good interaction between teachers, parents, students, and institutions helps support learning activities. These changes still need to be addressed and managed, and teachers and schools meaningfully use existing facilities and techniques to achieve a superior and skilled Indonesian golden generation. A teacher must be more creative and innovative in designing practical learning activities. Therefore, teachers must always be ready for any changes or developments that follow the demands of the times. **Teacher competence has been identified as mastery of a task, teaching and educating skills, attitudes, and appreciation needed to support the success of the learning process.**

The infrastructure that supports online learning must be balanced with the ability of teachers, students, and parents to use it. The infrastructure that supports online learning is described as follows. Smartphone implementation applications must function properly, such as Google Classroom, Zoom Meeting, and other learning applications (Egitia, 2021; Jupri et al., 2022). In addition, joint coordination between all parties is necessary for the smooth learning process. Communication between teachers and parents needs to be improved, not only with students, it aims to monitor student progress. When teachers offer online learning, efforts to increase teacher creativity and technological literacy are needed. **It is necessary to increase motivation for students** so that **students** feel enthusiastic about learning mathematics at home or under the guidance of their parents. Teachers participate in various online training courses to help them support the online learning process, especially mathematics and science learning. Even though learning is done without face-to-face, teachers need to be able to increase student activity in learning mathematics and science by applying attractive learning models, and media, such as using Google Forms applications or mathematics applications as educational support (Egitia, 2021). Based on the research of Rerendo et al., the importance of discussions with members of the Mathematics MGMP (Subject Teacher Conference) as well as through the mathematics teacher community, the Development Program for Mathematics Teachers, training on the use of technology in the mathematics learning process for mathematics teachers, and teacher training on how to use online learning support media. This activity has a positive impact, namely helping to use the Geogebra application and the zoom meeting platform or google classroom.

Mathematics is one of the important sciences in all areas of human life. Mathematics, as one of the subjects taught in schools, contributes to the achievement of national education goals and trains Indonesian people to be productive, creative, innovative, and emotional (Jupri et al., 2022). Students need mathematics useful in everyday life, for example, in solving problems and understanding other fields of study such as physics, chemistry, architecture, pharmacy, geography, and economics. Any profession requires mathematics.

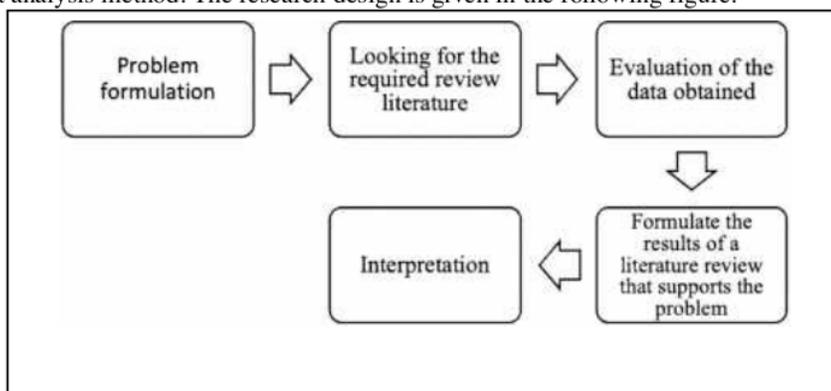
Indonesia and the world have felt a decline in the COVID-19 outbreak. However, we still need to be aware that this pandemic has not stopped, so prevention efforts still need to be carried out, and everyone needs to be vigilant. With the experience of teachers implementing online learning models, teachers need to modify learning to adapt to current conditions as a post-pandemic situation. This study aims to analyze the professional identity and competence of mathematics and science teachers needed in dealing with the learning process after the Covid-19 pandemic.



**Research Method**

This study used the systematic literature review method. The literature study method consists of collecting library data, reading, taking notes, and managing research materials (Zed, 2014). Cooper states that research with a literature study approach includes reviews, summaries, and author opinions obtained from collecting related data/information in previous studies. By using a literature study, it is expected to be able to examine the data more deeply and find out the level of professionalism of mathematics and science teachers during the covid-19 pandemic.

Research activities were carried out by collecting information and data with the help of various materials in the library, such as reference books, similar previous research results, articles, notes, and multiple journals related to the problem to be solved. Researchers collected data by conducting searches from websites, books, and articles in Scopus-indexed international journals. The technique used by researchers in analyzing the data was using the content analysis method. The research design is given in the following figure.



**Figure 1. Teacher Professional Identity Research Design**

**Results and Discussion**

Mathematics and science teachers must have four competencies to teach well (Dirgantoro, 2018; Jupri et al., 2022). The research data findings are displayed in Table 2, which can describe it.

**Table 2. Teacher Professional Identity**

No	Criteria	Description
1.	Pedagogical competence	Teachers understand the developmental stages of their students (Lian & Amiruddin, 2021). Teachers can choose and implement appropriate learning strategies to help and motivate students to learn mathematics (Windari et al., 2020; Taniredja et al., 2016).
2.	Social competence	A teacher with good teaching skills can organize learning activities and create conditions that facilitate learning (Moreno-guerrero et al., 2020).
3.	Personality competence	Teachers must be role models for their students regarding attitude and language (Windari et al., 2020; Taniredja et al., 2016).



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	Teachers must exercise patience and self-control in the classroom, especially if they find students with low ability (Moreno-guerrero et al., 2020).
4. Professional competence	Teachers must have excellent communication skills with students, other teachers, educational staff, parents/guardians of students, and the community (Moreno-guerrero et al., 2020). The unique skills that every mathematics teacher must possess are: (1) number theory; (2) measurement and evaluation; (3) mathematical logic; (4) geometric concepts; (5) statistical and probability concepts; (6) functions (7) algebraic concepts; (8) computational concepts and analytical geometry; (9) discrete mathematical concepts and procedures; (10) trigonometry; (11) vectors and matrices; and (12) historical and philosophical explanations of mathematics (Dirgantoro, 2018).

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The following is an exposure based on Table 2. Regarding pedagogical competence, a teacher must understand his students in studying mathematics and science. Teachers must also understand the stages of student development (Lian & Amiruddin, 2021). With this knowledge and understanding, teachers can choose and implement appropriate learning strategies to help and motivate students to learn mathematics. In learning mathematics, a teacher with good teaching skills can organize learning activities to create conditions conducive to learning. In personality competence, a mathematics teacher must be a role model and example for students regarding attitude and speech. Until recently, the growing assumption about mathematics teachers was that they were aggressive, rude, and picky. This assumption must be changed by the attitudes and words of the mathematics teacher during classroom learning. A mathematics teacher must practice patience and self-control in the classroom, especially when directing less gifted students. Becoming a teacher who is truly a "teacher" is not easy work. Social competence is one of the most important competencies required for the successful performance of the teaching profession. In the profession of a teacher, many abilities must be mastered by Teachers, professionally, educationally, personally, and with social skills (Windari et al., 2020; Moreno-guerrero et al., 2020).

Regarding professional competence, mathematics, and science teachers must have good communication skills with students, other teachers, education staff, parents/guardians of students, and the community. Mathematics teachers must have open ears and hearts, especially listening to comments and criticism so that students can learn better. Teachers should listen and accompany students when students come to class unprepared to learn (Lian & Amiruddin, 2021; Moreno-guerrero et al., 2020). With good professional competence, teachers can carry out the learning process. In professional competence, the unique skills that every mathematics teacher must possess are (1) the use of numbers, number relationships, different number systems, and number theory; (2) using measurement and evaluation; (3) using mathematical logic; (4) using geometric concepts; (5) using statistical and probability concepts; (6) using templates and functions (7) using algebraic concepts; (8) using computational concepts and analytical geometry; (9) using discrete mathematical concepts and procedures; (10) using trigonometry; (11) using vectors and matrices; (12) historical and



philosophical explanations of mathematics; and (13) can use teaching aids, measuring instruments, calculating tools, computer software, mathematical and statistical models (Dirgantoro, 2018). These competencies require mathematics teachers to master mathematical material to guide students through these materials. For that, the teacher needs to summarize something interesting to learn. Teachers can develop questions that stimulate students to reflect on and practice the problem-solving process. The teacher's questions should be open and encourage students to learn by working together.

### Discussion

Based on Law Number 14 of 2005 concerning Teachers and Lecturers, four competencies need to be possessed by a teacher in Indonesia: professional competence, pedagogic competence, personality competence, and social competence (Panggabean & Himawan, 2016; Afriliamanda & Zainil, 2019; Nadia, 2020). Each of these competencies refers to the mastery of the subject matter for the field of study; mastery of theory and skills in implementing and evaluating the teaching and learning process; having a steady, stable, wise, authoritative, exemplary personality, and a noble character; and the ability to communicate effectively with students, education staff, parents or guardians of students, and the surrounding community. Again, according to the Law on Teachers and Lecturers, teachers, including mathematics teachers, can receive training and professional development for teachers following their respective fields of study. Mathematics teachers are entitled to training and professional development in mathematics and appropriate teaching and learning skills in mathematics education (Jupri et al., 2022; Windari et al., 2020; Taniredja et al., 2016; Dewi, 2015).

The ethnographic study of Victoria Deneroff (Deneroff, 2016) tells of the reflexive development of science teacher identity, which is the result of Marie Gonzales' research, as a springboard for imagining and exploring how professional development can be designed to facilitate the reflexive transformation of identity in professional learning environments. Teacher professional development is paramount among the resources needed to support effective teaching and learning in mathematics and science (e.g., teacher preparation, principal support, and leadership, public-private partnerships) (Smith et al., 2007). April Luehmann argues that teaching and learning in mathematics and science, for example, through inquiry, is more than just learning a set of skills and cognitive activities. It involves developing a socially inquiry-oriented teacher identity, which recognizes the teacher's "professional philosophy, passion, commitment, way of acting, interacting, values and morals" (Luitel, 2020; Keith Weber & Kathryn Rhoads, 2011). He continued that professional development opportunities should not only provide an experience for teachers to become competent with the practice of teaching mathematics and science, for example, inquiry-based, but also create a cadre of professionals who recognize themselves, and each other, as members of a socio-cultural group of educators who value and practice science through inquiry.

Good professional development challenges teachers to learn more about the subject matter, student thinking, and learning practices. Furthermore, teachers need to participate in networking with other professionals. William Penuel studies science teacher professional development focusing on teaching practice (Luitel, 2020). William Penuel surveyed 454 primary and secondary school teachers to learn about the impact of professional development on their knowledge and implementation of science programs using an inquiry approach. Teachers report that they need time to plan, adapt, and implement the approach into their



curriculum so that the professional development experience feels like a good “fit” between the curriculum and the demands placed on them. Practical teaching, not identity, has often been used as a reference for professional development. To improve professionalism, a teacher needs to develop learning skills and techniques during a pandemic, namely distance learning. According to Sudrajat (Dirgantoro, 2018), some of the skills needed for distance learning the first is learning literacy about science and technology. Teacher insight on technology and literacy in distance learning so that teachers and students are ready to carry out their respective roles. Learning resources from the internet make it easy for students to study independently without being limited by space and time.

Second, mastery of classroom management techniques. Redinger et al. (Redinger et al., 2020; Bryce et al., 2016) recommend several steps of a virtual approach in classroom-based learning, first hands-on practice. Conduct a practice session before familiarizing yourself with the virtual class to avoid unexpected technical errors. Next, set the expected value. At the beginning of the session, teachers need to clarify their expectations to avoid confusion and misunderstanding, such as explaining the virtual learning tools used, the technical tools being studied, and others. Third, involve students in the learning process. Teachers are encouraged to use a constructive learning approach to encourage student activity during the learning process. Fourth, ask for feedback. Wait about 5 minutes, then provide feedback at the end of the session and integrate the input and suggestions in the feedback into the next lesson plan.

Third, communication and social skills. Teachers need to establish good communication with their parents. Parents should counsel and mentor students during distance learning (Almarashdi & Jarrah, 2021). Good communication between teachers and parents is expected to allow them to provide feedback during the learning process. If it goes well, then follow the expected results.

### **Conclusion**

From the reviewed article, the researchers conclude that teachers play an important role in implementing government policies in education. Learning in the post-pandemic era still requires the active role of teachers, especially in technological abilities. With the presence of blended learning or face-to-face learning, teachers need to improve their competence. Some of the learning process's obstacles are adapting to learning model changes. What was originally distance learning turned into face-to-face learning. It can be a challenge for teachers to remain professional in carrying out the learning process. Teachers must fully understand their role to actively involve students in learning and create a good learning environment. To become professional teachers in the post-pandemic era, teachers must further improve literacy, science and technology, classroom management, and communication with parents. The results are some skills a mathematics and science teacher should have this time. Multiple Skills is the experience of implementing learning during the COVID-19 pandemic. It includes basic science literacy, classroom management skills online and offline, active student engagement, and especially communication skills with parents.

### **Recommendation**

Based on this literature study, the recommendations for teachers are that teachers need to communicate effectively with their students, colleagues, and parents. Second, teachers must be dependable. Students and colleagues must know that teachers can rely on them to be on time and prepared. Lastly, teachers must have good judgment. Principals can improve teacher



pedagogic and personality competence by holding several programs, including workshop training activities, supervision of learning, encouraging teachers to participate in MGMP, continuing education, and giving appreciation or awards to outstanding teachers.

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