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## What is Needed and Prepared to Become a Mathematics Teacher?

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### Abstract

The mathematics teacher profession has become a challenging and interesting profession in the era of technological advancement and global competition. The fact that mathematics is difficult is not able to stop prospective new students from becoming mathematics teachers. This is a basic asset that they have seen the opportunities behind challenges. This article aims to provide an overview of prospective mathematics teacher candidates regarding the opportunities, hopes, demands, and challenges of becoming a mathematics teacher. To accommodate this goal, the article is divided into two main sections related to the question: What does it take to be a mathematics teacher? What is to be prepared to become a mathematics teacher? Both of these questions are answered in their respective sections in the hope that they can give an idea of what needs to be done, what has been done, and how the students of mathematics teacher candidates will follow their studies.

**Keywords:** Teacher education, mathematics teacher, teacher competence, prospective teacher

## *Apa yang Diperlukan dan Disiapkan untuk Menjadi Seorang Guru Matematika?*

### Abstrak

Profesi guru matematika menjadi sebuah profesi yang menantang dan sekaligus menarik di era kemajuan teknologi dan persaingan global. Fakta bahwa matematika adalah sulit, tidak mampu membendung calon mahasiswa baru untuk menjadi guru matematika. Ini menjadi modal dasar bahwa mereka telah melihat peluang di balik tantangan. Artikel ini bertujuan untuk memberikan gambaran kepada mahasiswa calon guru matematika tingkat awal terkait peluang, harapan, tuntutan, dan tantangan untuk menjadi guru matematika. Untuk mewadahi tujuan tersebut, artikel dibagi menjadi dua bagian utama yang dikaitkan dengan pertanyaan: Apa yang diperlukan menjadi guru matematika? Apa yang perlu disiapkan menjadi guru matematika? Kedua pertanyaan tersebut dijawab di bagian masing-masing dengan harapan dapat memberikan gambaran tentang apa yang harus dilakukan, apa yang sudah dilakukan, dan bagaimana selanjutnya oleh mahasiswa calon guru matematika menapaki perkuliahan.

**Kata kunci:** Pendidikan guru, guru matematika, kompetensi guru, calon guru

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## INTRODUCTION

Previously, when we are asked by a neighbor or a friend: "*Brother [Sister], where do you study? What major did you choose?*" Many of us are ashamed to answer that we entered the teacher education study program. This makes sense, because in the past, the teachers' profession was considered an underestimation for reasons of small salaries and it was not uncommon of them to have to do other work (e.g. motorcycle taxis) after returning from teaching. Now, the paradigm is slowly beginning to change, now the teachers' profession is a dream profession. The usual salary received was small at some time before, to be changed 3 or 4 times the basic salary every month, which consists of basic salary, certification, and other benefits. Even so, there are some criticisms from people around us about teacher identity. It is undeniable that some of us entered the teacher study program, not all of which came from self-motivation to become teachers. Some enter the teacher study program because they are asked by their parents, or because they see work opportunities, or because they are related to costs, or because they are related to the choices made not in their favor, or because of interactions with the environment that leads them. Some of these reasons certainly have a significant impact on achievement motivation and studying, especially at the beginning of the study period.

A reasonable condition and situation when teacher study programs are in demand by prospective students consisting of various socioeconomic status and cultural backgrounds and are based on various motivations. Prospective students have certainly weighed opportunities, measured expectations, looked at demands, and predicted the challenges of the department or program they wanted to take. Based on the first author's experience and observations of trends in various tertiary institutions which are teacher education institutions, prospective new students for teacher study programs that are ranked in the top three are elementary school teacher education study program, mathematics education study program, and English education study program. One of the three study programs is interesting to get more attention, namely the mathematics education study program. The large number of prospective new students in this study program is contrary to the fact that most people find it difficult to study mathematics. The phenomenon that develops in the community is that schooling in mathematics education study programs has more opportunities than other teacher education programs, one of which is the labor market for this study program can become a teacher at various levels of school, namely elementary school, junior high school, senior high school. In other words, there are more employment opportunities.

In addition to being a teacher at various levels of the school, the fact that most people find it difficult to study mathematics becomes an opportunity to open several tutoring institutions and in fact, mathematics subjects become priority subscriptions in these tutoring programs. Expectations and opportunities to become a lecturer are also very wide even though on condition that they must continue to graduate school. This makes sense because it is in line with Permendikbud number 49 of 2014 and Director General of Higher Education Decree No. 108/DIKTI/Kep/2001, that each study program must have 6 permanent lecturers. Moreover, according to DIKTI standards, the ratio of lecturers and students is 1: 20 (tolerance of 1: 30) for the natural sciences and 1: 30 (tolerance of 1: 45) for the social sciences. This standard is also used for the sake of accreditation, so it requires universities to have a proportional number of lecturers and in fact many universities do not meet this standard. In other words, universities in both state and private universities must inevitably have to meet the needs of lecturers and lecturers in mathematics education to be one sector that requires more human resources because of the relatively large number of students. Therefore, the opportunity to become a lecturer (especially in the field of mathematics education) is now higher than some time before the regulation was published.

### WHAT IS A MATHEMATICS TEACHER REQUIRED?

The answer to the question "*what does it take to be a mathematics teacher?*" certainly cannot be explained easily and briefly. However, mathematics teachers are required and are expected to have at least four competencies, namely pedagogical competence, professional competence, social competence, and personality competence. This is in line with the expectations of the nation enshrined in the Teacher and Lecturer Law 2005 article 8 that teachers are required to have academic qualifications, competencies, educator certificates, be healthy physically and spiritually, and have the ability to realize national education goals. This competence can be defined as knowledge, skills, and attitudes that are used as the basis for *mastering a certain situation* and expressed through action (Kunter et al., 2013; Liakopoulou, 2011; Van Loo & Semeijn, 2004). *The certain situation* referred to in this context is the situation related to the teacher's work.

In their work, teachers are expected to have skills in managing teaching and learning. These skills are called pedagogical competencies. Skills in managing teaching and learning include expertise in teaching methodology, knowledge of students, knowledge of curriculum, general pedagogical knowledge, knowledge of assessment and evaluation, and knowledge of technology (Liakopoulou, 2011; Shulman, 1986, 1987).

The skills in managing teaching and learning are not sufficient to stand alone to deliver students *learning with understanding*. The teacher must master the content taught comprehensively. These skills are often associated with professional competence. The term professional competence is related to the application of concepts to *working life*, especially in professions that have high demands and complexities, which control the situation depends on knowledge, skills, and attitudes that influence each other (Kunter et al., 2013). In other words, mathematics teachers have professional competence if they have the knowledge, expertise, and attitudes that are able to support in being responsible for their profession. The teacher's profession related to teaching and mastering the mathematics content taught is a form of his responsibility towards the profession.

Pedagogical and professional competencies are two inseparable variables, both of which influence each other. Teachers who master content but are weak in pedagogical competencies result in students' difficulty in *learning with understanding*. On the other hand, pedagogical knowledge cannot stand alone to deliver students *learning with understanding* because content cannot be packaged as something that is challenging, interesting and understanding for students. Therefore, Shulman (1987) states that a combination of pedagogical knowledge and content knowledge is needed for effective teaching. This combination is often called *pedagogical content knowledge*. Shulman's seminal ideas then became lively discussed and developed into a framework in the research and development of mathematics teacher education (Ball, Thames, & Phelps, 2008; Fennema & Franke, 1992; Godino, Batanero, Roa, & Wilhelmi, 2008; Koehler & Mishra, 2005).

Competence not only covers cognitive aspects (e.g. knowledge), but also noncognitive aspects. Bouley et al. (2015) illustrates professional competence into two components, namely cognitive (professional knowledge) and noncognitive components as follows.

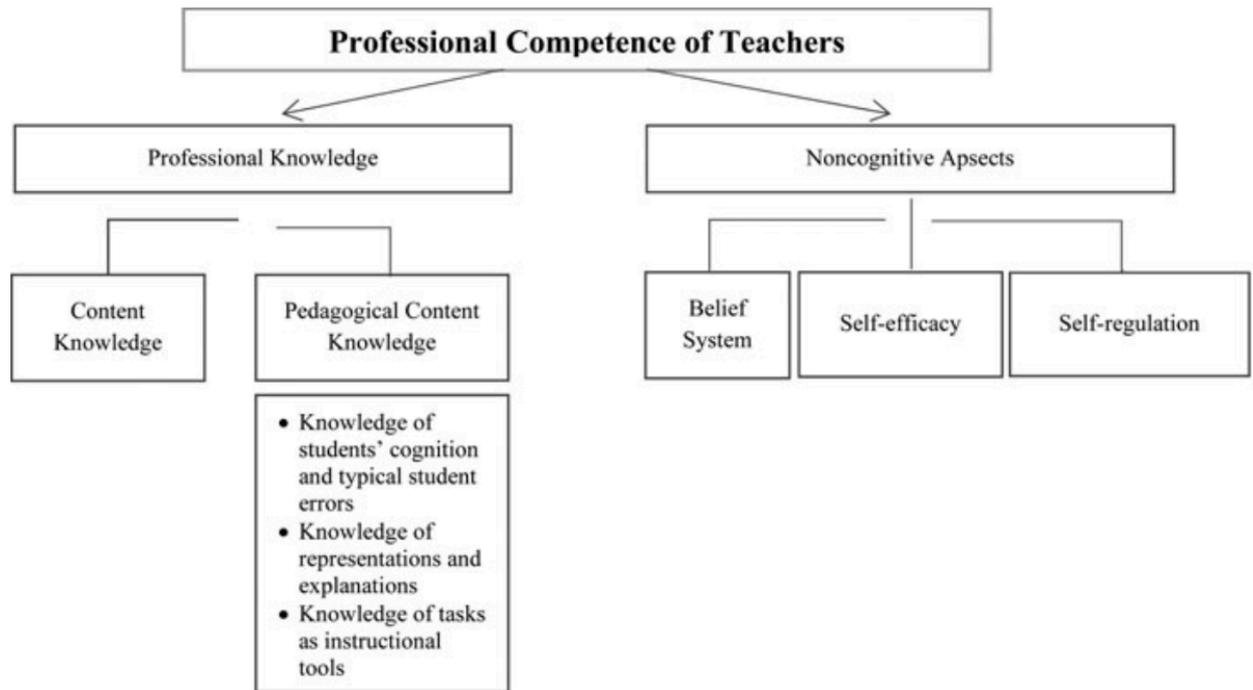


Figure 1. Components of Teacher Professional Competence

Figure 1 shows the very close relationship between professional competence and pedagogical competence, especially in the components of professional knowledge and pedagogical knowledge. A more detailed explanation of the components of knowledge that must be possessed by mathematics teachers to teach you can see in the studies of Ball and colleagues (Ball et al., 2008; Hill, Ball, & Schilling, 2008).

The teacher is a profession that is and develops in the community and is limited by the community. Therefore, teachers are also required to have the skills to be able to interact both within the scope of the community related to their profession and the more general community. The ability to interact with the community can be useful both in the context of increasing professional and pedagogical competence. Social competence is also a variable that reduces a person's *behavioral problems*, which is related to his personality (Langeveld, Gundersen, & Svartdal, 2012). This skill is called social competence. This social competence refers to the knowledge, expertise, and attitudes of a person needed to adapt and interact in the community (Swan, 2006).

Another competency expected by a teacher is personality competence. According to Law No. 14 of 2015, personality competence refers to the ability of individuals who reflect a steady, stable, mature, wise and authoritative personality, set an example for students, and have good character. The importance of this competency can be exemplified by acting in accordance with religious, legal, social and cultural norms, having pride and confidence that he is a teacher, not only giving examples but also being able to be examples, wise, mature, dignified, and uphold the professional code of ethics of the profession teacher.

#### **WHAT IS TO BE PREPARED TO BECOME A MATHEMATICS TEACHER?**

There is a conception of most people that to get success in work, including teachers, is to have a high Grade Point Average (GPA). The GPA has been conceptualized as a satisfying tool to date, especially for institutions that use it for the purpose of screening, guaranteeing, and evaluating the quality of the programs being implemented. Therefore, it is not surprising that almost every institution makes GPA an administrative

requirement. However, the GPA cannot guarantee a person has the ability to everything that is required by his profession. More than that, GPA inconsistencies and one's success also become a *joke* in the middle of society with phrases like the following: "Don't worry about students who have a GPA with an average A category, because they will be your colleagues, but we need to worry about GPA students with an average C or D category because they have more opportunities to become policy makers". Although this phrase is just a joke in the middle of society, but in fact to achieve success is not enough to rely on the high GPA.

Robbins et al. (2004) dan Richardson, Abraham, dan Bond (2012) provide information about the factors that influence academic success at the university level. The critical success factors are classified as traditional or cognitive factors such as standardized test scores, school *rankings*, and GPA; demographic factors such as socio-economic status and gender; and psycho-social factors such as social involvement, self-efficacy, study habits, self-management, effort, and resilience. Of these factors, demographic factors are given, cannot be changed, whereas cognitive factors and psycho-social factors can develop along with the experience gained in the study environment. Cognitive factors and psycho-social factors also develop along with the four competencies previously mentioned, namely pedagogical, professional, personality, and social competencies. Therefore, henceforth, we limit the scope in the context of what prospective teachers must prepare and not in the context of improving the teacher education system. Some of these arguments are only based on the experience of the first author, so they can then be linked to relevant literature to strengthen the argument.

*First*, students need to have experience that can provide opportunities to interact with children, mathematical content, and the work environment. This experience can be done by working part time, that is, not oriented to the financial side, so that it does not interfere with his involvement in the environment. Some possible ways include being a lecturer assistant, teacher assistant, private tutor, instructor, or others. Some of the advantages of having this experience, including (1) getting used to the characteristics and potential of students, so that the ability to predict the strengths and weaknesses of children can be honed. This knowledge is referred to by Ball and colleagues as knowledge of content and student (Ball et al., 2008; Hill et al., 2008); (2) familiar with the characteristics of the content being taught, so that challenges and difficulties can be used to enhance pedagogical content knowledge; (3) accustomed to the work climate, which is able to mature, wise, and authoritative; (4) enhance responsibilities and communication skills because they already have direct experience interacting with students, content, and work environment; and (5) fostering unyielding attitudes towards pressure, motivation, self-efficacy, beliefs, and other non-cognitive aspects.

*Second*, organizing and joining learning clubs is a quick way for students to actualize themselves and develop directly or indirectly into the four competencies mentioned earlier. *Why do you have to organize?* There are several advantages of organizing including (1) enhancing psycho-social development, especially in building and clarifying college goals, involvement in college, career planning, self-management, and a culture of participation (Foubert & Urbanski, 2006); (2) fostering a proud attitude towards the campus and its chosen studies; (3) fostering adherence to regulations or prevailing norms. This is important to foster an attitude of upholding the norms and code of ethics of teachers; and (4) have experience on how to be part of finding solutions to problems related to lectures. It's important to always sharpen yourself in seeing the opportunities behind challenges.

*Third*, engaging in lecturer activities is a surefire way to absorb more experience. A lecturer has four obligations which include elements of teaching (and other relevant forms), research, community service, and supplementary elements. The element of research and community service allows lecturers to interact with students. This opportunity needs to be used by students because it provides several advantages including (1) building a healthy

academic culture; (2) the relationship between the student concerned and the lecturer is more fluid, thus providing motivation for students; (3) students gain experience in research and community service so they can understand the importance of research-based teaching and community service.

## CONCLUSION

The cognitive aspect is important, but the non-cognitive aspect has its portion to determine the success of students in the level of lectures and in turn is useful to lead to successful teachers. Both of these aspects can be obtained during the lecture period, namely by (1) finding experiences to interact with students, content, and work environment; (2) organized; and (3) actively involved in lecturer activities.

## REFERENCES

- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content Knowledge for Teaching: What Makes It Special? *Journal of Teacher Education*, 59(5), 389–407. <https://doi.org/10.1177/0022487108324554>
- Bouley, F., Wuttke, E., Schnick-Vollmer, K., Schmitz, B., Berger, S., Fritsch, S., & Seifried, J. (2015). Professional Competence of Prospective Teachers in Business and Economics Education: Evaluation of a Competence Model Using Structural Equation Modeling. *Peabody Journal of Education*, 90(4), 491–502. <https://doi.org/10.1080/0161956X.2015.1068076>
- Fennema, E., & Franke, M. L. (1992). Teachers' knowledge and its impact. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 147–164). New York, NY: Macmillan Publishing Co, Inc.
- Foubert, J. D., & Urbanski, L. A. (2006). Effects of Involvement in Clubs and Organizations on the Psychosocial Development of First-Year and Senior College Students. *Journal of Student Affairs Research and Practice*, 43(1), 166–182. <https://doi.org/10.2202/1949-6605.1576>
- Godino, J. D., Batanero, C., Roa, R., & Wilhelmi, M. R. (2008). Assessing and developing pedagogical content and statistical knowledge of primary school teachers through project work. In G. B. C. Batanero C. Reading & A. Rossman (Ed.), *ICMI/IASE 2008* (Vol. 18). Monterrey: ICMI and IASE.
- Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education*, 39(4), 372–400.
- Koehler, M. J., & Mishra, P. (2005). What Happens When Teachers Design Educational Technology? The Development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32(2), 131–152. <https://doi.org/10.2190/OEW7-01WB-BKHL-QDYV>
- Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: Effects on instructional quality and student development. *Journal of Educational Psychology*, 105(3), 805–820. <https://doi.org/10.1037/a0032583>
- Langeveld, J. H., Gundersen, K. K., & Svartdal, F. (2012). Social Competence as a Mediating Factor in Reduction of Behavioral Problems. *Scandinavian Journal of Educational Research*, 56(4), 381–399. <https://doi.org/10.1080/00313831.2011.594614>
- Liakopoulou, M. (2011). Teachers' pedagogical competence as a prerequisite for entering

- the profession. *European Journal of Education*. <https://doi.org/10.1111/j.1465-3435.2011.01495.x>
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138(2), 353–387. <https://doi.org/10.1037/a0026838>
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do Psychosocial and Study Skill Factors Predict College Outcomes? A Meta-Analysis. *Psychological Bulletin*, 130(2), 261–288. <https://doi.org/10.1037/0033-2909.130.2.261>
- Shulman, L. S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher*, 15(2), 4–14.
- Shulman, L. S. (1987). Knowledge and teaching: foundation of the new reform. *Harvard Educational Review*, 57(1), 1–21.
- Swan, M. (2006). Designing and using research instruments to describe the beliefs and practices of mathematics teachers. *Research in Education*. <https://doi.org/10.7227/RIE.75.5>
- Van Loo, J., & Semeijn, J. (2004). Defining and Measuring Competences: An Application to Graduate Surveys. *Quality and Quantity*, 38(3), 331–349. <https://doi.org/10.1023/B:QUQU.0000031320.86112.88>

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