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SELF-ASSESSMENT OF PROFESSIONAL COMPETENCIES OF STUDENTS OF THE FACULTY OF TEACHER EDUCATION IN MATHEMATICS TEACHING

Abstract: *The research deals with the self-assessment of professional competencies of students and trainees of the Faculty of Teacher Education in teaching mathematics, with an emphasis on the role of practical teaching and efficiency. 121 respondents participated in the research, and the results show that respondents generally have a positive attitude towards their mathematical and pedagogical competencies. Trainees are assessed as more confident and efficient than students, which is associated with a higher number of hours of practical training. Previous secondary school education did not show a significant advantage over vocational education when it comes to assessing knowledge and ability to teach mathematics. A positive correlation was found between the assessment of one's own mathematical knowledge and effectiveness in teaching, which confirms the importance of quality practical teaching and continuous development of professional competencies of future teachers. The research also contributes to the understanding of the professional competencies of teachers in mathematics teaching and supports further research that would include qualitative checks of the attitudes of practicing teachers as well as a comparison of teachers' effectiveness in subject teaching.*

Keywords: *mathematical competences, practical teaching, efficiency*

INTRODUCTION

Teachers' professional competencies are the backbone of the discourse on the quality of teaching that contributes to the development of student performance. This important role of the teacher and his professional qualifications, as well as the identification of the teaching profession as a profession, put teacher education in the focus of scientific research

(Füting-Lippert et al., 2024). The globalization of education requires future-oriented competencies, which prepare future teachers to adapt to a changing educational environment (Ludwikowska, 2019). Teacher competencies imply acquired knowledge, developed skills, and acquired values during initial education at teacher training studies, as well as lifelong adoption and development of competencies necessary for modern work in the educational process (Topolovčan, 2011). Not only does a competent teacher master the content of the subject, but they also possess the ability to manage the class, communicate appropriately with students, and have a stimulating approach to the development of their potential (Caena and Redecker, 2019). Therefore, the education of future teachers emphasizes the development of appropriate professional competencies, especially in the didactic approach to subjects (Kunter et al., 2013), because the quality of teacher education is one of the main factors that affect the level of students' educational achievements (Jurić, 2007). The quality of education of future teachers, according to the European Commission (European Commission, 2018), is reflected in the encouragement of active learning focused on the future teacher as well as the development of his or her competences based on practice. The implementation and application of practical teaching in the work of teacher education studies enable the enrichment of theoretical and empirical knowledge acquired in the university environment (Munna and Kalam, 2021). Professional competencies acquired during studies in various subjects and fields (Jentsch and König, 2022) become a prerequisite for the professional success of teachers (Zlatkin-Troitschkanskaia et al., 2017) and have a positive impact on student success (Perera and John, 2020). The concept of competence is complex, and there is no single definition. Teaching competencies in the Republic of Croatia are regulated by the Croatian Qualifications Framework, which bases qualification standards on learning outcomes and harmonizes them with the needs of the labour market and society (Ministry of Science and Education, 2017). Competencies represent a systematic connection of knowledge, abilities, skills, and attitudes (Cindrić, Milković, and Strugar, 2016). Jurčić (2012) defines competencies as the teaching art of planning, organizing, controlling, leading, and evaluating the educational process. Keuffer (2010) differentiates them into cognitive abilities and skills that represent professional knowledge, belief, values, and motivational orientation. At the same time, Đuranović, Klasnić, and Lapat (2012) emphasize the need for a modern teacher to possess and permanently improve professional, pedagogical, communication, information, and IT competences. The professional competencies of future teachers acquired during their studies need to be developed throughout their lives. At the same time, any comprehensive model of teacher competence development must include the transformation of knowledge into practice (European Commission, 2018). This is best achieved by knowing and teaching the content of a subject

with the application of pedagogical knowledge, integrated and linked to practical experiences in schools. Therefore, this research aims to examine the attitudes of students of the Faculty of Teacher Education on the application of professional competencies in mathematics teaching in the context of professional-pedagogical practice regarding previous secondary education and status, to examine the self-assessment of effectiveness on the knowledge and teaching of mathematics, and to verify their connection.

PROFESSIONAL COMPETENCIES OF TEACHERS IN MATHEMATICS TEACHING

The modern approach to teaching requires the teacher to apply the specific competencies of a particular subject in addition to general competencies, planning, organization, and evaluation. The European Commission's guidelines (2005) emphasize the importance of mathematical competence as a fundamental value for lifelong learning. For the OECD (2005) and the European Commission (2005), mathematical competence is at the heart of research and policy initiatives. At the same time, the OECD (2005) defines mathematical competence as the ability of an individual to identify and understand the role of mathematics in the world and to judge and thoughtfully use mathematics for the purpose of life needs. The National Framework Curriculum for Preschool Education and General Compulsory and Secondary Education (2010) defines mathematical competence as the ability to develop and apply mathematical thinking in everyday problem solving. Mathematics teaching should be well planned and competently managed, with Matijević (2014) emphasizing the irreplaceable role of teachers in the application of new didactic and methodological approaches. Teachers use mathematical skills to encourage students' mathematical competencies (Mišurac, 2014) with the application of adequate content and activities in accordance with learning outcomes. Mathematics teachers are required to have specific competencies that will enable them to assist students in understanding mathematical concepts and skills (Toom et al., 2021). While for Nissa (2003) they represent knowledge, understanding, the ability to act and apply mathematics, Gülteke, Tomul and Korur (2013) classify them into three categories: knowledge of content, knowledge of teaching and knowledge of mathematical values. In addition to general mathematical competencies, problem solving, argumentation, communication, modelling and content representation, Horvat (2019) also lists specific mathematical competencies that imply mathematical skills and knowledge, and include numbers and arithmetic, algebra and functions, geometry, quantities and measurement, data, probability and statistics. Contemporary professional competencies of mathematics teachers should include process-oriented skills that test real and authentic connections from

everyday life through simulation and modelling, with the use of mathematical tools (Cevikbas et al., 2023). In accordance with the above, mathematical competences include not only the ability to perform mathematical operations and solve problems (OECD, 2005), but also the understanding and application of mathematics in various aspects of life.

STUDENTS' ATTITUDES TOWARDS TEACHING MATHEMATICS

Students' attitudes about the competencies acquired during their studies, practical classes, and introduction to work directly affect the quality of the teaching profession, and thus the success of students. The quality of teaching (Kunter et al., 2013) depends on the competences of the teacher who, through the application of knowledge, knowledge of pedagogical content, and enthusiasm for teaching, achieves positive effects on the success of students. Therefore, the question arises whether students have developed adequate knowledge of the content of the subjects they teach during their studies, as well as pedagogical competences about students, curriculum, and educational context, as recommended by the European Commission (2017). Primary education students of the Integrated Undergraduate and Graduate Study Program of the Faculty of Teacher Education in Zagreb, according to the Lecture Schedule in the academic year 2024/2025, receive practical classes in the course Methodology of Mathematics lasting 90 hours. An analysis of the teaching practice of teacher education studies in Europe indicates a difference, not only in the content and duration of the programme, but also in the philosophy, objectives, and methods of evaluation (Flores et al., 2016). Students' attitudes towards acquired competencies and practical teaching indicate insufficient application and connection of theoretical knowledge in practical work (Cardarello and Pasciuti, 2004). To better connect theory and practice, Michelini (2003) emphasizes the importance of three dimensions in teacher education: metacultural, experiential, and reflective. Neuweg (2004) interprets the problem of connecting the theory and practice of future teachers as a problem of establishing a relationship between teaching knowledge and teaching skills. Korthagen, Loughran, and Russell (2006) see the solution to the insufficient application of practical teaching in the application of the experiential learning model, because it is practical teaching that develops knowledge and mathematical competencies (Livy, Vale, and Herbert, 2016). Students highlight the advantage of greater participation in practical mathematics teaching (Butterfield et al., 2025) because, in doing so, they apply the acquired knowledge, improve mathematical skills, and choose the appropriate approach to teaching (Khalid, 2014).

ASSESSMENT OF TEACHERS' EFFECTIVENESS IN MATHEMATICS TEACHING

A high level of efficiency, as a reflection of one's own abilities, motivates a person to succeed in life. Teacher competencies refer to professional knowledge and skills, while self-efficacy is a broader concept that represents a belief in their implementation. Educational studies on self-efficacy are based on Bandura's theory (Bandura, 1997), which holds that beliefs about self-efficacy influence the way of thinking and feeling, which consequently encourages or prevents one's actions. In doing so, a person with a high level of self-efficacy embarks on a greater feat, while vice versa, it leads to inactivity and inefficiency. Lazarides, Buchholz, and Rubach (2018) consider teacher self-efficacy to be a key factor influencing educational outcomes, defined as teachers' beliefs in their ability to influence student engagement and achievement. Mok and Moore (2019) highlight the positive association between teacher self-efficacy and teaching effectiveness, emphasizing that teachers with higher self-efficacy are more effective educators. They show a greater preference for innovative methods, better planning, and adaptability, resulting in higher-quality teaching and outcomes (Li, 2023; Holzberger and Prestele, 2021). Bandura (1997) defined mathematical self-efficacy as a belief or perception in one's own mathematical abilities. According to Ferla, Valcke, and Cai (2009), mathematical self-efficacy represents an individual's confidence to successfully solve a particular mathematical problem. The concept of self-efficacy in teaching mathematics is a teacher's belief or perception of their own abilities to successfully teach mathematics. Gavora (2010) associates teachers with a high sense of self-efficacy for teaching mathematics with their positive behaviour in teaching because they use more effective methods, accept new ideas (Henson, 2001), and show greater interest and commitment to work (Tschannen-Mora and Hoy, 2001). Siegle and McCoach (2007) have a direct relationship with the teacher's self-efficacy in teaching mathematics, which consequently affects the student's success (Kahle, 2008). Research on efficiency relations on knowledge and teaching of mathematics (Unlu and Ertekin, 2013) has shown a significant positive correlation among future teachers, and it is necessary to determine their contribution to the acquisition of professional competencies. The professional competencies of a teacher for teaching mathematics depend on their effectiveness, which consequently affects the quality of teaching and student achievement. At the same time, the quality of teaching is the result of the education and professionalization of teachers.

METHODOLOGY

Aim and problems of the research

Professional competencies of future teachers for knowledge and teaching of mathematics should develop modern standards of mathematical

competencies, which include problem solving, thinking, reasoning, proving, communication, connecting, and representation to encourage students' active and independent acquisition of knowledge. This research aims to examine the attitudes of students of the Faculty of Teacher Education on the application of professional competencies in mathematics teaching in the context of professional-pedagogical practice regarding previous secondary education and status, to examine the self-assessment of effectiveness on the knowledge and teaching of mathematics, and to verify their connection. In accordance with the above, the following research problems and hypotheses derived from the associated research tasks were set:

1. To check whether there is a statistically significant difference in the attitudes of students and trainee teachers on the application of professional competencies in mathematics teaching and the assessment of effectiveness regarding status (student/trainee).
   H1 There is a statistically higher assessment of attitudes towards the application of competences by trainee teachers compared to other respondents due to the higher number of hours achieved in practical classes.
   H2 Trainee teachers, due to the higher number of hours achieved in practical classes, are assessed as more efficient compared to other respondents.
2. To check whether there is a statistically significant difference in the assessment of efficiency in the knowledge and teaching of mathematics regarding completed secondary education (gymnasium/vocational).
   H3 There is a statistically higher self-assessment of knowledge of mathematics in respondents with completed gymnasium education in accordance with a higher number of hours of learning mathematics compared to other respondents.
   H4 Subjects with previously completed secondary school education, due to the greater number of hours of mathematics during education, are assessed as more capable of teaching mathematics than other subjects.
3. Check whether there is a correlation between the efficiency assessment of knowledge and effectiveness in mathematics teaching.
   H5 We assume that there is a statistically significant correlation between the variables of efficiency assessment on knowledge and teaching of mathematics, i.e., that those who are assessed as more skilled in mathematics are also assessed as more effective for teaching mathematics.

The results of the research are presented through a descriptive analysis of the scale of respondents' attitudes about the application of professional

competences in mathematics teaching and self-assessment of effectiveness. When processing the results, the non-parametric Mann-Whitney U test was used.

Sample of subjects and research procedure

A total of 121 respondents participated in the research, of whom 96.7% (N = 117) were teachers and 3.3% (N = 4) were teachers. Depending on the status of teachers, 50.4% (N = 61) were students, 5th year of the Faculty of Teacher Education, and 49.6% (N = 60) were trainee teachers. Regarding previous secondary education, significantly more respondents, 81.0% (N = 98), completed a gymnasium program, while 19.0% (N = 23) completed a vocational school. The research was conducted in 2024 using a questionnaire in direct contact with respondents. Participation was voluntary and anonymous. Two questionnaires were used. For the research of professional competencies, a questionnaire by Makamura and Jit (2019) was used, which examines the competencies of knowledge and teaching mathematics. The questionnaire consisted of 24 statements, of which 5 refer to mathematical knowledge and 19 to the teaching of mathematics. The claims are categorized into nine factors: F1 − motivational strategies, F2 − student-faculty readiness, F3 − classroom management, F4 − teaching strategies, F5 − pedagogical competence, F6 − student knowledge, F7 − impact of teaching practice on math teaching, F8 − school workroom support, and F9 − instructional resources. For the purpose of investigating the effectiveness of mathematics teaching, the Mathematics Teaching Efficacy Belief Instrument (MTEBI), taken from the authors Enochs, Smith, and Huinker (2000), was used. The instrument (MTEBI) contains 21 statements and consists of two factors: F1 − personal effectiveness of teaching mathematics and F2 − expected outcomes of teaching mathematics. In both questionnaires, the respondents evaluated the statements based on previous experience on a five-point scale of Likert's type of intensity: (1 = strongly disagree, 2 = partially disagree, 3 = undecided, 4 = partially agree, 5 = strongly agree).

RESULTS AND DISCUSSION

Respondents' Attitudes on the Application of Professional Competencies in Mathematics and Efficiency Teaching

Before the statistical processing related to the set research problems, a descriptive analysis of the results of the scale of respondents' attitudes on the application of professional competencies in mathematics teaching and self-assessment of effectiveness (Table 1 and Table 2) is presented.

Table 1
Descriptive Values of the Attitude Scale on the Application of Professional Competencies in Mathematics Teaching

	M	C	D	SD	skew	Kurt	-	+	To
K1. Teacher Training has prepared me well for teaching.	3.8	4.0	4	0.88	-0.79	0.84	1	5	<.01
K2. I feel confident in teaching math.	3.9	4.0	4	0.84	-0.72	0.67	1	5	<.01
K3. I have the right skills to manage the class.	4.3	4.0	5	0.76	-1.02	0.95	2	5	<.01
K4. I understand how students learn mathematics.	4.0	4.0	4	0.82	-0.50	-0.28	2	5	<.01
K5. I know how to apply different teaching approaches during class at the right time.	4.1	4.0	4	0.78	-0.42	-0.60	2	5	<.01
K6. Different mathematical approaches during teaching can confuse students.	3.3	3.0	3	1.07	0.06	-0.68	1	5	<.01
K7. Knowledge of different teaching approaches allows me to apply them.	4.4	5.0	5	0.66	-0.73	-0.51	3	5	<.01
K8. I use the textbook quite often during teaching.	3.9	4.0	4	1.05	-0.68	-0.32	1	5	<.01
K9. I know how to choose an appropriate teaching tool (specifics) to improve the way of teaching mathematics.	4.3	4.0	4	0.65	-0.66	0.28	2	5	<.01
K10. Practical classes allow me to try out the teaching methods that were adopted during my studies.	4.4	5.0	5	0.75	-1.07	0.81	2	5	<.01
K11. During practical classes, I learned the way students learn mathematics.	4.0	4.0	4	0.89	-0.75	0.01	2	5	<.01
K12. The skills and methods acquired during the study are applicable in practical teaching.	4.0	4.0	4	0.86	-0.47	-0.59	2	5	<.01
K13. They can motivate students who lack interest in learning math.	3.9	4.0	4	0.76	-0.21	-0.45	2	5	<.01
K14. I have a good relationship with students during work.	4.7	5.0	5	0.49	-1.42	0.98	3	5	<.01
K15. I'm worried about how to help students who are slower at work.	3.9	4.0	5	1.08	-0.76	-0.21	1	5	<.01
K16. I know how to adapt the ways of teaching to students with different backgrounds.	3.9	4.0	4	0.81	-0.32	-0.42	2	5	<.01

Table 1 *(continued)*

K17. I additionally work with students every time they have difficulties in understanding the material.	4.3	5.0	5	0.84	-1.08	0.48	2	5	<.01
K18. I respect and accept students' ideas and suggestions.	4.4	5.0	5	0.68	-0.73	-0.58	3	5	<.01
K19. I allow students to apply their own learning methods.	4.2	4.0	5	0.81	-0.54	-0.70	2	5	<.01
K20. I can assess and evaluate a student's achievement in math teaching.	4.3	4.0	5	0.78	-0.79	-0.23	2	5	<.01
K21.The school (exercise room for students) supports me during practical classes.	4.2	4.0	5	0.91	-1.10	1.17	1	5	<.01
K22. Teacher Training Studies help me during observation in Training Schools.	4.0	4.0	4	0.89	-0.60	0.03	1	5	<.01
K23. Teaching is a vocation that fulfils me.	4.5	5.0	5	0.80	-1.57	1.70	2	5	<.01
K24. My expectations before observing classes coincide with my experiences during practical classes of student exercises.	3.5	4.0	4	1.05	-0.39	-0.61	1	5	<.01

LEGEND: M – arithmetic mean, C – central value, D – dominant value, SD – standard deviation, skew – curvature, kurt – flattening, - − lowest score, + − highest score, K – significance of the Kolmogorov-Smirnov test for testing the normality of distribution

From the results (Table 1), it is evident that the respondents mostly or completely agreed with 23 statements and expressed indecision with only one statement − *Different mathematical approaches during teaching can confuse students* (M = 3.3, C = 3.0). They strongly agree (4.5 or more) with the statements: *I have a correct relationship with students during work* (M = 4.7, C = 5.0) and *Teaching is a fulfilling vocation* (M = 4.5, C = 5.0). The largest number of respondents (3.5−4.4) agree with the statements: *Practical teaching allows me to try out teaching methods that have been adopted during my studies* (M = 4.4, C=5.0), *Knowledge of different teaching approaches allows me to apply them* (M = 4.4, C = 5.0), *I respect and accept students' ideas and suggestions* (M = 4.4, C = 5.0), *I have appropriate classroom management skills* (M = 4.3, C = 4.0), *I know how to choose an appropriate teaching tool to improve the way mathematics is taught* (M = 4.3, C = 4.0), *I additionally work with students whenever they have difficulties in understanding the material* (M = 4.3, C = 5.0), *I can assess and evaluate students' achievements in teaching mathematics* (M = 4.3, C = 4.0), *I allow students to apply their own learning methods* (M = 4.2, C = 4.0), *The school (exercise room for students) supports me during practical classes* (M = 4.2, C = 4.0), *I know how to apply different*

teaching approaches during the lesson at the right time (M = 4.1, C = 4.0), *In practical classes I learned the way students learn mathematics* (M = 4.0, C = 4.0), *Skills and methods acquired during studies are applicable in practical classes* (M = 4.0, C = 4.0), *I understand how students learn mathematics* (M = 4.0, C=4.0), *Teacher Education helps me during observation in training schools* (M = 4.0, C = 4.0), *I can motivate students who lack interest in learning mathematics* (M = 3.9, C = 4.0), *I worry about how to help students who are slower in work* (M = 3.9, C = 4.0), *I know how to adapt teaching methods to students with different prior knowledge* (M = 3.9, C = 4.0), *I feel confident in teaching mathematics* (M = 3.9, C = 4.0), *I often use a textbook while teaching* (M = 3.9, C = 4.0), *Teacher Training has prepared me well for teaching in class* (M = 3.8, C = 4.0) and *My expectations before observing in class coincide with the experiences during practical classes of student exercises* (M = 3.5, C = 4.0). In the results, we notice that there are no attitudes in which the agreement of the respondents is small or very small. Such results indicate an extremely positive attitude of respondents toward the application of professional competencies in mathematics teaching. A review of the normality testing of distributions by the Kolmogorov-Smirnov test showed that all attitudes on the application of professional competencies differ statistically significantly from the normal distribution, and therefore, nonparametric statistical data processing was used in further processing.

Table 2
Descriptive values of the Self-Assessment Performance Attitude Scale

	M	C	D	SD	skew	Kurt	-	+	To
U1. When a student performs better in math, it is because the teacher has put in more effort.	3.8	4.0	4	0.86	-0.70	0.77	1	5	<.01
U2. I will keep finding better ways to teach math.	4.4	5.0	5	0.67	-0.79	-0.49	3	5	<.01
U3. Despite trying very hard, I will not teach math as well as other subjects in lower classes.	2.2	2.0	1	1.24	0.91	-0.08	1	5	<.01
U4. When students perform better in math, it is because the teacher finds a more effective approach to teaching.	4.0	4.0	4	0.79	-0.75	1.14	1	5	<.01
U5. I know how to teach math content effectively.	3.9	4.0	4	0.83	-0.60	0.47	1	5	<.01
U6. I will not be as effective at keeping track of a student's math activities.	2.2	2.0	2	1.02	0.59	-0.14	1	5	<.01

Table 2 *(continued)*

U7. If students show poorer results in math, it is most likely due to ineffective math teaching.	3.2	3.0	3	0.98	-0.41	-0.14	1	5	<.01
U8. In general, I do not think I am going to teach math effectively.	1.7	2.0	1	0.92	1.26	1.15	1	5	<.01
U9. A student's insufficient mathematical knowledge can be overcome by good teaching.	4.0	4.0	4	0.70	-0.18	-0.48	2	5	<.01
U10. When a student with poor performance in mathematics progresses, it is usually due to the teacher's extra attention to them.	3.7	4.0	4	0.78	-0.38	0.46	1	5	<.01
U11. I understand mathematical processes well enough to be effective in initial mathematics classes.	4.2	4.0	4	0.77	-0.76	0.10	2	5	<.01
U12. The teacher is generally responsible for the student's achievement in mathematics.	3.3	3.0	3	0.91	-0.35	0.17	1	5	<.01
U13. Student success in mathematics is directly related to effective teaching by teachers.	3.4	3.0	3	0.94	-0.25	-0.13	1	5	<.01
U14. Parents believe that the child's increased interest in mathematics at school reflects the teacher's efficiency.	3.6	4.0	4	1.00	-0.25	-0.75	1	5	<.01
U15. I will have difficulty using aids while teaching math processes.	2.1	2.0	2	1.01	0.81	0.23	1	5	<.01
U16. I will mostly be able to answer students' questions.	4.4	4.0	5	0.71	-1.09	1.41	2	5	<.01
U17. I wonder if I will have the necessary skills to teach mathematics.	2.7	2.0	2	1.21	0.26	-1.00	1	5	<.01
U18. If possible, I will not invite the head of school to evaluate how I teach mathematics.	2.7	3.0	3	1.27	0.25	-0.91	1	5	<.01
U19. If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him.	2.3	2.0	2	1.05	0.75	0.18	1	5	<.01
U20. I will be glad if students ask questions during math teaching.	4.6	5.0	5	0.69	-2.13	6.29	1	5	<.01
U21. I do not know what should be done to get students to do math.	2.2	2.0	2	1.06	0.64	-0.30	1	5	<.01

LEGEND: M – arithmetic mean, C – central value, D – dominant value, SD – standard deviation, skew – curvature, kurt – flattening, - − lowest score, + − highest score, K – significance of the Kolmogorov-Smirnov test for testing the normality of distribution

From the results (Table 2), it is evident that the respondents fully agreed with only one statement – *I will be glad if students ask questions* (M = 4.6; C = 5.0). They most agreed with the statements: *I will constantly find better ways to teach mathematics* (M = 4.4; C = 5.0), *I will mostly be able to answer the students' questions* (M = 4.4; C = 4.0), *I understand mathematical processes well enough to be effective in the initial teaching of mathematics* (M = 4.2; C = 4.0), *When students achieve better results in mathematics it is because the teacher finds a more effective approach to teaching* (M = 4.0; C = 4.0), *Insufficient student's mathematical knowledge can be overcome by good teaching* (M = 4.0; C = 4.0)), *I know how to effectively teach mathematical content* (M = 3.9; C = 4.0), *When a student performs better in mathematics it is because the teacher has put in more effort* (M = 3.8; C = 4.0), *When a student with poor performance in mathematics makes progress, it is usually due to the teacher's extra attention to him* (M = 3.7; C = 4.0) and *Parents believe that the child's increased interest in mathematics at school is a reflection of the teacher's effectiveness* (M = 3.6; C = 4.0). Respondents expressed indecision in the statements: *Students' success in mathematics is directly related to effective teacher teaching* (M = 3.4; C = 3.0), *The teacher is generally responsible for the student's achievement in mathematics* (M = 3.3; C = 3.0), *If students show poorer results in mathematics, it is most likely due to ineffective mathematics teaching* (M = 3.2; C = 3.0), *I question myself if I will have the necessary skills to teach mathematics* (M = 2.7; C = 2.0) and *If possible, I will not invite the principal to evaluate how I teach mathematics* (M = 2.7; C = 3.0). The results indicated the existence of attitudes in which respondents do not agree with the statements: *If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him* (M = 2.3; C = 2.0), *Despite trying very hard, I will not teach mathematics as well as other subjects in primary education* (M = 2.2; C = 2.0), *I will not be as effective at monitoring the student's math activities* (M = 2.2; C = 2.0), *I don't know what should be done to get students to do math* (M = 2.2; C = 2.0), *I will have difficulty using aids while teaching mathematical processes* (M = 2.1; C = 2.0) and *In general, I feel that I will not teach mathematics effectively* (M = 1.7; C = 2.0). Here, too, a review of the normality testing of distributions by the Kolmogorov-Smirnov test showed that all distributions of efficiency results differ statistically significantly from the normal distribution. Therefore, non-parametric statistics were used in further processing.

Differences in attitudes towards the application of professional competencies in mathematics teaching regarding status

To answer the question of whether there is a statistically significant difference in attitudes towards the application of professional competencies

in mathematics teaching regarding status (student, trainee), a nonparametric Mann-Whitney U test was conducted. The point-biserial correlation coefficient was calculated as the magnitude of the effect, with the criterion of a small effect size of up to 0.3, a medium of 0.3 to 0.5 and a large of more than 0.5 (Table 3).

Table 3
Mann-Whitney U test when testing the difference in attitudes towards the application of professional competencies in mathematics teaching regarding status

	student		trainee				
	M	C	M	C	Z	p	r
K1. Teacher Training Has Prepared Me Well for Teaching.	3.9	4.0	3.8	4.0	-0.35	.73	-.02
K2. I feel confident in teaching math.	3.7	4.0	4.2	4.0	-2.79	.01	.27
K3. I have the right skills to manage the class.	4.2	4.0	4.4	4.0	-0.76	.45	.09
K4. I understand how students learn mathematics.	3.7	4.0	4.3	4.0	-4.36	.00	.39
K5. I know how to apply different teaching approaches during class at the right time.	4.0	4.0	4.3	4.0	-2.13	.03	.17
K6. Different mathematical approaches during teaching can confuse students.	3.2	3.0	3.5	3.0	-1.74	.08	.15
K7. Knowledge of different teaching approaches allows me to apply them.	4.3	4.0	4.6	5.0	-2.74	.01	.26
K8. I use the textbook quite often during teaching.	3.5	4.0	4.3	4.0	-3.91	.00	.36
K9. I know how to choose an appropriate teaching tool (specifics) to improve the way of teaching mathematics.	4.3	4.0	4.4	4.0	-1.11	.27	.12
K10. Practical classes allow me to try out the teaching methods that were adopted during my studies.	4.3	4.0	4.4	5.0	-0.81	.42	.05
K11. During practical classes, I learned the way students learn mathematics.	4.0	4.0	4.0	4.0	-0.19	.85	-.01
K12. The skills and methods acquired during the study are applicable in practical teaching.	4.1	4.0	4.0	4.0	-0.64	.52	-.06
K13. They can motivate students who lack interest in learning math.	3.8	4.0	4.1	4.0	-2.27	.02	.22
K14. I have a correct relationship with students during work.	4.7	5.0	4.7	5.0	-0.46	.65	-.04
K15. I am worried about how to help students who are slower at work.	3.9	4.0	3.9	4.0	-0.50	.62	.02

Table 3 (*continued)*

K16. I know how to adapt the ways of teaching to students with different backgrounds.	3.7	4.0	4.2	4.0	-3.27	.00	.30
K17. I additionally work with students every time they have difficulties in understanding the material.	4.0	4.0	4.6	5.0	-4.05	.00	.36
K18. I respect and accept students' ideas and suggestions.	4.3	4.0	4.6	5.0	-2.49	.01	.20
K19. I allow students to apply their own learning methods.	4.1	4.0	4.3	4.0	-1.35	.18	.13
K20. I can assess and evaluate a student's achievement in math teaching	4.1	4.0	4.5	5.0	-2.97	.00	.28
K21. The school (exercise room for students) supports me during practical classes.	4.0	4.0	4.3	4.0	-1.37	.17	.14
K22. Teacher Training Studies help me during observation in Training Schools.	4.0	4.0	4.0	4.0	-0.21	.83	-.01
K23. Teaching is a vocation that fulfils me.	4.4	5.0	4.7	5.0	-1.58	.11	.18
K24. My expectations before observing classes coincide with my experiences during practical classes of student exercises.	3.4	4.0	3.6	4.0	-1.14	.26	.09

LEGEND: M – arithmetic mean, C – central value, Z – Mann-Whitney U test, p – probability of error, r – point-biserial correlation coefficient as the value of the effect magnitude

The results obtained (Table 3) showed that there are ten statistically significant differences in the application of competencies depending on status for attitudes: *I feel confident in teaching mathematics* ($z = -2.79$, $p < .01$, $r = .27$), *I understand how students learn mathematics* ($z = -4.36$, $p < .01$, $r = .39$), *I can apply different teaching approaches during class at the right time* ($z = -2.13$, $p < .05$, $r = .17$), *Knowledge of different teaching approaches allows me to apply them* ($z = -2.74$, $p < .01$, $r = .26$), *I use the textbook quite often during teaching* ($z = -3.91$, $p < .01$, $r = .36$), *I can motivate students who lack interest in learning mathematics* ($z = -2.27$, $p < .05$, $r = .22$), *I know how to adapt teaching methods to students with different prior knowledge* ($z = -3.27$, $p < .01$, $r = .30$), *I additionally work with students whenever they have difficulties in understanding the material* ($z = -4.05$, $p < .01$, $r = .36$), *I respect and accept students' ideas and suggestions* ($z = -2.49$, $p < .01$, $r = .20$), *I can assess and evaluate students' achievements in mathematics classes* ($z = -2.97$, $p < .01$, $r = .28$). The obtained mean values showed that interns scored higher on all ten statements compared to students. Thus, the hypothesis (H1) on the existence of a statistically significant difference in the attitudes of respondents on the application of professional competencies for teaching mathematics is partially confirmed.

Differences in attitudes towards the assessment of effectiveness in mathematics teaching regarding status (student/trainee)

To answer the question of whether there is a statistically significant difference in attitudes towards the assessment of effectiveness in mathematics teaching regarding status (student, trainee), a non-parametric Mann-Whitney U test was conducted. Here, too, the point-biserial correlation coefficient was calculated as the magnitude of the effect, with the criterion of a small effect size of up to 0.3, a medium of 0.3 to 0.5 and a large one of more than 0.5 (Table 4).

Table 4
Mann-Whitney U test when testing the difference in attitudes about assessing effectiveness in mathematics teaching regarding status

	student		trainee				
	M	C	M	C	Z	p	r
U1. When a student performs better in math, it is because the teacher has put in more effort.	3.7	4.0	3.8	4.0	-0.59	.56	.06
U2. I will keep finding better ways to teach math.	4.3	4.0	4.5	5.0	-1.97	.05	.14
U3. Despite trying very hard, I will not teach math as well as other subjects in lower classes.	2.1	2.0	2.3	2.0	-0.10	.92	.06
U4. When students perform better in math, it is because the teacher finds a more effective approach to teaching.	4.0	4.0	4.0	4.0	-0.17	.87	.01
U5. I know how to teach math content effectively.	3.7	4.0	4.2	4.0	-3.52	.00	.33
U6. I will not be as effective at keeping track of a student's math activities.	2.1	2.0	2.4	2.0	-1.64	.10	.16
U7. If students show poorer results in math, it is most likely due to ineffective math teaching.	3.1	3.0	3.2	3.0	-0.05	.96	.03
U8. In general, I do not think I am going to teach math effectively.	1.8	2.0	1.7	1.0	-0.33	.74	-.01
U9. A student's insufficient mathematical knowledge can be overcome by good teaching.	4.0	4.0	4.0	4.0	-0.02	.99	-.01
U10. When a student with poor performance in mathematics progresses, it is usually due to the teacher's extra attention to him.	3.7	4.0	3.7	4.0	-0.53	.60	.02
U11. I understand mathematical processes well enough to be effective in initial mathematics classes.	4.0	4.0	4.5	5.0	-3.28	.00	.30
U12. The teacher is generally responsible for the student's achievement in mathematics.	3.0	3.0	3.5	4.0	-2.81	.01	.26

Table 4 (*continued)*

U13. Student success in mathematics is directly related to effective teacher teaching.	3.2	3.0	3.7	4.0	-2.50	.01	.24
U14. Parents believe that the child's increased interest in mathematics at school reflects the teacher's efficiency.	3.6	4.0	3.7	4.0	-0.45	.65	.04
U15. I will have difficulty using aids while teaching math processes.	2.1	2.0	2.1	2.0	-0.76	.45	-.03
U16. I will mostly be able to answer students' questions.	4.3	4.0	4.4	5.0	-0.88	.38	.07
U17. I wonder if I will have the necessary skills to teach mathematics	2.7	2.0	2.6	2.0	-0.44	.66	-.03
U18. If possible, I will not invite the head of school to evaluate how I teach mathematics.	3.0	3.0	2.3	2.0	-2.84	.00	-.26
U19. If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt how to help him.	2.2	2.0	2.3	2.0	-0.19	.85	.03
U20. I will be glad if students ask questions during math teaching.	4.5	5.0	4.6	5.0	-1.12	.26	.05
U21. I do not know what should be done to get students to do math	2.4	2.0	2.1	2.0	-1.35	.18	-.11

LEGEND: M – arithmetic mean, C – central value, Z – Mann-Whitney U test, p – probability of error, r – point-biserial correlation coefficient as the value of the effect magnitude

The results obtained (Table 4) have shown that there are six statistically significant differences in attitudes towards the assessment of effectiveness in mathematics teaching for the following attitudes: *I will constantly find better ways to teach mathematics* ($z = -1.97$, $p < .05$, $r = .14$), *I know how to teach mathematics content effectively* ($z = -3.52$, $p < .01$, $r = .33$), *I understand mathematical processes well enough to be effective in initial mathematics teaching* ($z = -3.28$, $p < .01$, $r = .30$), *The teacher is generally responsible for the student's achievement in mathematics* ($z = -2.81$, $p < .05$, $r = .26$), *The student's success in mathematics is directly related to the effective teaching of the teacher* ($z = -2.50$, $p < .05$, $r = .24$) and *If possible, I will not invite the principal to assess how I teach mathematics* ($z = -2.84$, $p < .01$, $r = -.26$). The obtained mean values showed that interns achieved higher scores on all six statements compared to students. Thus, the hypothesis (H2) on the existence of a statistically significant difference in the attitudes of respondents on the assessment of efficiency in mathematics teaching was partially confirmed. The results obtained showed similarities with the research of Giles, Byrd, and Bendolph, (2016), who observed positive levels

of efficiency in teaching mathematics in trainees. Furthermore, the findings are also consistent with Briley's (2012) which found that elementary school teachers have strong beliefs in their abilities to teach mathematics effectively, despite less work experience.

Self-assessments of performance on knowledge of mathematics regarding completed secondary education

To answer the question of whether there is a statistically significant difference in the assessment of the effectiveness of knowledge of mathematics regarding secondary education (vocational school, gymnasium), a non-parametric Mann-Whitney U test was conducted. Here, too, the point-biserial correlation coefficient was calculated as the effect size with the criterion of a small effect size of up to 0.3, a medium size of 0.3 to 0.5 and a large one of more than 0.5 (Table 5).

Table 5
Mann-Whitney U test when testing the difference in performance assessment on knowledge of mathematics with respect to secondary education

	vocational school		gymnasium				
	M	C	M	C	Z	p	r
U2. I will keep finding better ways to teach math.	4.6	5.0	4.4	5.0	-1.14	0.26	-0.12
U5. I know how to teach math content effectively.	4.1	4.0	3.9	4.0	-0.77	0.44	-0.08
U11. I understand mathematical processes well enough to be effective in initial mathematics classes.	4.1	4.0	4.3	4.0	-0.97	0.33	0.06
U15. I will have difficulty using aids while teaching math processes.	2.0	2.0	2.1	2.0	-0.66	0.51	0.04
U16. I will mostly be able to answer students' questions.	4.3	4.0	4.4	4.0	-0.03	0.98	0.01
U17. I wonder if I will have the necessary skills to teach mathematics.	2.3	2.0	2.8	3.0	-1.76	0.08	0.16
U19. If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him.	2.3	2.0	2.3	2.0	-0.25	0.80	0.01
U20. I will be glad if students ask questions during math teaching.	4.7	5.0	4.6	5.0	-0.88	0.38	-0.08

LEGEND: M – arithmetic mean, C – central value, Z – Mann-Whitney U test, p – probability of error, r – point-biserial correlation coefficient as the value of the effect magnitude

The results obtained showed that there are no statistically significant differences in the assessment of efficiency in mathematics knowledge regarding secondary education. Educational background (secondary education) is associated with epistemic beliefs (Corkin, Ekmekci, and Papakonstantinou, 2015), which suggests that with more hours of mathematics during education, high school students acquire more knowledge about the subject. Despite this paradigm and the assumption that high school students are consequently assessed as more efficient, the results of this research did not prove it. Therefore, the respondents with previously completed gymnasium education, despite the greater number of hours of learning mathematics compared to the vocational program, were not assessed as more efficient in their knowledge of mathematics. With this, we can say that the third hypothesis (H3) is not confirmed.

Self-assessments of effectiveness in teaching mathematics regarding completed secondary education

To answer the question of whether there is a statistically significant difference in the assessment of efficiency for teaching mathematics regarding secondary education, we used the non-parametric Mann-Whitney U test. The magnitude of the effect was also calculated as a point-biserial correlation coefficient (Table 6).

Table 6
Testing the difference in efficiency depending on the completed secondary school – vocational or gymnasium

	vocational school		gymnasium				
	M	C	M	C	Z	p	r
U1. When a student performs better in math, it is because the teacher has put in more effort.	4.0	4.0	3.7	4.0	-1.65	0.10	-0.17
U2. I will keep finding better ways to teach math.	4.6	5.0	4.4	5.0	-1.14	0.26	-0.12
U3. Despite trying very hard, I will not teach math as well as other subjects in lower classes.	1.9	2.0	2.3	2.0	-0.91	0.36	0.11
U4. When students perform better in math, it is because the teacher finds a more effective approach to teaching.	4.3	4.0	3.9	4.0	-2.04	0.04	-.186
U5. I know how to teach math content effectively.	4.1	4.0	3.9	4.0	-0.77	0.44	-0.08
U6. I will not be as effective at keeping track of a student's math activities.	2.1	2.0	2.3	2.0	-0.90	0.37	0.08

Table 6 *(continued)*

U7. If students show poorer results in math, it is most likely due to ineffective math teaching.	3.1	3.0	3.2	3.0	-0.07	0.94	0.02
U8. In general, I do not think I am going to teach math effectively.	1.6	1.0	1.8	2.0	-0.90	0.37	0.07
U9. A student's insufficient mathematical knowledge can be overcome by good teaching.	4.1	4.0	4.0	4.0	-0.78	0.44	-0.07
U10. When a student with poor performance in mathematics progresses, it is usually due to the teacher's extra attention to him.	3.7	4.0	3.7	4.0	-0.21	0.83	-0.02
U11. I understand mathematical processes well enough to be effective in initial mathematics classes.	4.1	4.0	4.3	4.0	-0.97	0.33	0.06
U12. The teacher is generally responsible for the student's achievement in mathematics.	3.1	3.0	3.3	3.0	-0.89	0.37	0.07
U13. Student success in mathematics is directly related to effective teaching by teachers.	3.3	3.0	3.5	3.0	-0.37	0.71	0.05
U14. Parents believe that the child's increased interest in mathematics at school reflects the teacher's efficiency	3.7	4.0	3.6	4.0	-0.08	0.94	0.00
U15. I will have difficulty using aids while teaching math processes.	2.0	2.0	2.1	2.0	-0.66	0.51	0.04
U16. I will mostly be able to answer students' questions.	4.3	4.0	4.4	4.0	-0.03	0.98	0.01
U17. I wonder if I will have the necessary skills to teach mathematics.	2.3	2.0	2.8	3.0	-1.76	0.08	0.16
U18. If possible, I will not invite the principal to evaluate how I teach mathematics.	2.7	3.0	2.7	3.0	-0.04	0.97	0.01
U19. If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him.	2.3	2.0	2.3	2.0	-0.25	0.80	0.01
U20. I will be glad if students ask questions during math teaching.	4.7	5.0	4.6	5.0	-0.88	0.38	-0.08
U21. I do not know what should be done to get students to do math.	1.9	2.0	2.3	2.0	-1.79	0.07	0.17

LEGEND: M – arithmetic mean, C – central value, Z – Mann-Whitney U test, p – probability of error, r – point-biserial correlation coefficient as the value of the effect magnitude

The results showed that there is only one statistically significant difference depending on high school graduation with a small effect size for the statement: When students achieve better success in mathematics, it is because the teacher finds a more effective approach to teaching ($z = -2.04$, $p <, 0.04$, $r = -.19$). The difference did not go in the expected direction, i.e., respondents with a completed vocational school on this variable achieved a statistically significantly higher result than those with a high school diploma. Respondents with upper secondary education were not assessed as more effective at teaching mathematics, as shown by the study by Swackhamer et al (2009), in which the educational background of the respondents did not result in a significant difference in beliefs about the effectiveness of teaching mathematics between teachers who acquired more hours of mathematics through education compared to those who attended less. With this, we can say that the fourth hypothesis (H4) is not confirmed.

The Association Between Self-Assessment of Efficiency on Knowledge and Effectiveness on Teaching Mathematics

To answer the question of whether there is a statistically significant correlation in self-assessment of efficiency on knowledge and efficiency on teaching mathematics, we used a nonparametric Spearman coefficient of correlation between all variables of self-assessment of efficiency on knowledge of mathematics and efficiency on teaching mathematics (Table 7).

Table 7

Spearman's Correlation Coefficient Between Self-Assessment of Efficiency on Knowledge of Mathematics and Effectiveness on Teaching Mathematics

Self-assessments of effectiveness on teaching mathematics		Self-assessments of performance on knowledge of mathematics							
		U2	U5	U11	U15	U16	U17	U19	U20
U1. When a student performs better in mathematics, it is because the teacher has put in more effort.	r	.39	.10	.02	.14	.00	-.06	.06	.25
	p	<.01	>.05	>.05	>.05	>.05	>.05	>.05	<.01
U3. Despite trying very hard, I will not teach math as well as other subjects in lower classes.	r	-.11	-.19	-.15	.45	-.26	.36	.32	-.12
	p	>.05	<.05	>.05	<.01	<.01	<.01	<.01	>.05
U4. When students achieve better performance in mathematics, it is because the teacher finds a more effective approach to teaching.	r	.32	.14	-.03	.05	.05	.06	.09	.14
	p	<.01	>.05	>.05	>.05	>.05	>.05	>.05	>.05
U6. I will not be as effective at keeping track of a student's math activities.	r	-.18	-.11	-.01	.45	-.26	.31	.40	-.13
	p	>.05	>.05	>.05	<.01	<.01	<.01	<.01	>.05
U7. If students perform poorly in math, it is most likely due to ineffective math teaching.	r	.08	.14	.00	-.01	-.05	.16	.06	.02
	p	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05
U8. In general, I do not think I am going to teach maths effectively.	r	-.26	-.41	-.31	.57	-.47	.39	.47	-.27
	p	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
U9. A student's insufficient knowledge of mathematics can be overcome by good teaching.	r	.32	.16	.16	-.11	.12	-.02	-.26	.26
	p	<.01	>.05	>.05	>.05	>.05	>.05	<.01	<.01
U10. When a student with poor performance in mathematics progresses, it is usually due to the teacher's extra attention to them.	r	.25	.01	.06	.11	.13	.11	.06	.17
	p	<.01	>.05	>.05	>.05	>.05	>.05	>.05	>.05
U12. The teacher is generally responsible for the student's achievement in mathematics.	r	.23	.14	.17	.07	.17	.07	-.06	.17
	p	<.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05
U13. Student success in mathematics is directly related to effective teaching by teachers.	r	.14	.20	.23	.08	.18	.08	-.09	.12
	p	>.05	<.05	<.05	>.05	>.05	>.05	>.05	>.05
U21. I do not know what I should do to get students to do maths.	r	-.35	-.27	-.20	.40	-.29	.33	.41*	-.26
	p	<.01	<.01	<.05	<.01	<.01	<.01	<.01	<.01

LEGEND: U2 – I will constantly find better ways to teach math, U5 – I know how to teach math content effectively, U11 – I understand math processes well enough to be effective in initial math teaching, U15 – I will have difficulty using aids while teaching math processes, U16 – I will mostly be able to answer students' questions, U17 – I question whether I will have the necessary skills to teach math, U19 – If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him, U20 – I will be glad if students ask questions during mathematics teaching, r – Spearman's correlation coefficient, p – probability of error

The results of the examination of the correlation between knowledge and teaching of mathematics (Table 7) indicated that H5 was mostly confirmed. Some of the performance self-assessment variables on mathematics knowledge are related to individual performance self-assessment variables on mathematics teaching.

Variables: In general, *I feel that I will not teach mathematics effectively* and *I do not know what should be done to get students to do mathematics* are statistically significantly related to all variables of self-assessment of the effectiveness of knowledge of mathematics. Both variables are positively related to the statements *I will have difficulty using aids while teaching mathematical processes*, *I question whether I will have the necessary skills to teach mathematics* and *If I notice that a student has difficulty understanding mathematical processes, I will be in doubt about how to help him*, and negatively with all other statements that have a positive meaning.

The statement W*hen a student performs better in math it is because the teacher has put in more effort* is positively related to the statements *I will constantly find better ways to teach math* and *I will be glad if students ask questions while teaching math*. This proves that the respondents linked the teacher's effort and desire to improve their work with student success.

Claims *When students achieve better performance in mathematics it is because the teacher finds a more effective approach to teaching*, *When a student with poor performance in mathematics progresses, it is usually due to the teacher's extra attention to him* and *The teacher is generally responsible for the student's achievement in mathematics* are positively related to the statement *I will constantly find better ways to teach mathematics*. Here, the respondents linked student success with the teacher's approach, and they insisted on their own progress in the approach to teaching.

The statement *Despite trying very hard, I will not teach mathematics as well as other subjects in primary education* is negatively related to the statements: *I know how to teach math content effectively* and *I will mostly be able to answer students' questions* and positively with the statements *I will have difficulty using aids while teaching mathematical processes*, *I will question whether I will have the necessary skills to teach mathematics* and *If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him*. The *statement I will not be as effective in monitoring the student's mathematical activities* is positively related to the statements*: I will have difficulty using aids while teaching mathematical processes*, *I will question whether I will have the necessary skills to teach mathematics* and *If I notice that a student has difficulties in understanding mathematical processes, I will be in doubt about how to help him*. This indicates that respondents question their effectiveness for teaching by linking the uncertainty of the use of teaching aids, the application of mathematical skills and the methodical

approach to students who show misunderstanding. The same statement, *I will not be as effective at monitoring a student's math activities,* is negatively related to the statement *I will mostly be able to answer students' questions*, which proves that respondents who are considered ineffective at tracking math activities will not be proficient in answering students' questions. The statement *Insufficient student's mathematical knowledge can be overcome by good teaching* is positively related to the statements: *I will constantly find better ways to teach mathematics*, and *I will be glad if students ask questions during mathematics teaching*. In this way, the respondents proved a positive attitude towards the students' progress, as well as innovation in the application of different methods and ways of teaching to help students. The same statement, *Insufficient student's mathematical knowledge can be overcome by good teaching* is negatively related to the statement *If I notice that a student has difficulty understanding mathematical processes, I will be in doubt about how to help him*. In doing so, the respondents showed that they have the knowledge and skills necessary to help a student with difficulties in understanding mathematical processes. The direction of all the obtained associations was in line with our expectations, and the results are in line with the research of Zuya, Kwalat, and Attah (2016), which showed above-average levels of confidence in the assessment of efficiency in knowledge of mathematics and teaching mathematics among mathematics students, as well as their significant correlation.

CONCLUSION

In this study, the attitudes of students of the Faculty of Teacher Education on the application of professional competencies in mathematics teaching in the context of professional-pedagogical practice regarding previous secondary education and status, as well as the effectiveness of knowledge and teaching of mathematics and their connection, were examined. The results showed that students largely express positive attitudes towards the application of professional competencies in mathematics teaching. They consider teaching a vocation that fulfils them and are aware that they can apply the knowledge and skills acquired through their studies during practical classes. The adopted different teaching approaches enable the respondents to apply their knowledge while accepting the students' ideas. Students estimate that through their education at the faculty, they have acquired appropriate mathematical knowledge, classroom management skills, as well as the way of applying teaching aids to improve their work. These results are in line with research by Segarra, Julià and Valls (2021) on the positive correlation between mathematical knowledge and competencies acquired through study and performance assessment. The evaluation of efficiency in mathematics

teaching between students and trainees partially confirms that trainees are more effective. They are considered more effective in applying methods and ways of working, are more responsible for the student's achievements, and possess more knowledge for effective teaching. Such results confirm earlier research (Unlu and Ertekin, 2013, and Khale, 2008) in which trainee teachers show a high level of efficiency in the knowledge and teaching of mathematics. Similar results are brought by research by Giles, Byrd and Bendolph (2016), which states positive levels of effectiveness in teaching mathematics, experienced teachers, as well as novice teachers (Briley, 2012). The results on the application of professional competencies in mathematics teaching between students and trainees were partially confirmed. Despite the assessment that interns, due to the greater number of hours of practical application, are more competent than students, the research did not confirm this. Examining the assessment of efficiency on knowledge of mathematics regarding completed secondary education, the results show that there are no statistically significant differences between respondents who completed a gymnasium or vocational secondary school program. Such results coincide with the research of Twohill, NicMhuirí, Harbison, and Karakolidis (2022), which positively correlates the effectiveness of mathematics teaching with the achievements of future teachers in mathematics regardless of secondary education. The results of the connection between knowledge and teaching of mathematics show that those subjects who are assessed as more skilled in mathematics are also assessed as more effective for teaching. The results obtained are in line with previous research (Kahle, 2025) that showed a reciprocal correlation between teachers' effectiveness in knowledge and teaching of mathematics, as well as a study by Zuya, Kwalat, and Attah (2016) in which mathematics students showed an exceptional level of effectiveness in mathematics and mathematics teaching. This research contributes to the understanding of teachers' professional competencies in mathematics teaching and their application in practical teaching but also opens up space for further research that would include qualitative checks of practicing teachers and a comparison of teachers' effectiveness in subject teaching.

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