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## **EARLY SCHOOL MATHEMATICS EDUCATION FROM THE PERSPECTIVE OF FUTURE TEACHERS. REFLECTIONS AFTER PRACTICAL TEACHING PLACEMENT**

### **INTRODUCTION**

**I**t has been observed for years that the results of teaching mathematics prove to be unsatisfactory. A report of the Central Examination Committee (2018b) shows that in 2018 pupils obtained an average of 52% in the lower secondary end-of-school exam (while they scored 68% in the Polish language), and the matriculation exam (both in the new and old formula) in Polish language was passed by 97% of students, whereas in mathematics only 83% of graduates passed. It is Wood (2006) who categorically claims that frustration regarding the level of teaching and learning mathematics can be observed worldwide. The author quotes the statement of M.A.D. Wolters, a Dutch scientist, who states unequivocally that “nowadays there are no such teachers who would say that everything is fine in terms of teaching arithmetic. There are far too many children who do not

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like arithmetic, and, what is even worse, children who find the subject «stupid» (after: Wood, 2006, p. 209).

Such an unsatisfactory educational context implies the necessity of changes both in the area of students' activity and in teachers' preparation to conduct mathematics classes as early as at the level of early school education. Therefore, it seems significant to become familiar with the opinions of students of pedagogy concerning their readiness to teach mathematics. "Early school education students – according to Kalinowska – on one hand perceive learning mathematics through the prism of their own experiences, on the other – they have the opportunity to confirm or verify them thanks to the reflection during their studies. However, there arises a question: Does this reflection have a chance to «break through» the loads of often unpleasant encounters with maths at school that have been built for many years? Or it might be the case that the theories learned in the course of studies just «rinse» students' minds, without changing their way of thinking about teaching mathematics?" (Kalinowska, 2009, p. 360).

## THEORETICAL BACKGROUND

The 1999 education reform initiated the integrated teaching system in grades 1-3 of primary school, which provides a smooth, stepwise transition from pre-school education to education implemented in the school convention. The essence of such education is integration at the functional, methodological, organizational and content level. However, such organization of the didactic process contains traps and threats, which applies in particular to mathematics education. Recommending the inclusion of mathematics into integrated teaching, after a research conducted, however, Siwek draws a worrying conclusion: "in contemporary reality, integration often constitutes a threat to logical-mathematical thinking" (Siwek, 2004, p. 118).

What proves not to be conducive to an effective implementation of mathematical education is the so-called integration, in which "children are offered artificially created cross-curricular thematic chunks, calculations «dressed» in numerous versions of environmental associations, in which mathematics is perceived as counting snowmen in winter, flowers in the garden in spring and sorting out leaves while elaborating on the topic of the Polish autumn" (Nowak-Łojewska, 2015, p. 6). What Gruszczyk-Kolczyńska (2001) draws attention to is blatant disproportions observed when teachers very carefully implements other areas of early childhood education (Polish, social, environmental, artistic or musical education) at the expense of mathematical education. Numerous studies (Gruszczyk-Kolczyńska, 2001; Dąbrowski, 2008; Kalinowska, 2014) prove that teaching mathematics at the first level of school education is not of a critical-creative, conceptual nature that provides didactic effectiveness, but only a technical, transmissive-providing nature focused on training students to obtain the same pattern of correctness. Seidel and Sobieszczyk alarm that "teachers come with resistance to understand that teaching and learning is not

a «pedagogical monologue,» but “a «thoughtful dialogue between the teacher and students»” (Seidel, Sobieszczyk, 2007, p. 291). Mathematics does not constitute a favorite area of early school education teachers, and, as it is emphasized by Fechner-Sędzicka (2012, p. 5): “children succeed in learning mathematics thanks to the active involvement of teachers in their school education.” Quite an extreme opinion is expressed by Klus-Stańska and Nowicka (2005, p. 179), who refer to teachers’ mathematical incompetence. According to the authors “broad numbers of teachers (especially at the level of early childhood education) have significant problems with mathematical thinking.”

The above-mentioned unfavorable or even harmful tendencies observed in the process of teaching – learning mathematics in grades 1-3 imply the need for change at the stage of preparing future teachers to conduct early school mathematics education. It is the practical teaching placement that ought to introduce students to work in a school directly, and to perform various teaching practices appropriately and effectively. For the teaching placement creates opportunities to acquire first experience and inspire to further professional activity. Kozłowska (2015, p. 67) emphasizes the importance of practical placement both in a personal perspective, since “contact with children and school allows students to realize their capacities and preferences, recognize and assess their own predispositions to work as a teacher,” as well as, in the context of further university education, giving “the opportunity for students to verify their own knowledge and skills in a classroom reality.” However, what is highlighted by Sobieszczyk (2013, p. 385) is that “in the last two decades practical placement has become a neglected area,” the author also provides a number of innovations and corrective actions undertaken to improve the quality of this particular stage of teachers’ preparation for future work. One of the important elements of the new strategies concerning good practical teaching placement are students’ self-reflection and self-assessment.

## METHODOLOGY

The practical objective of the research was to determine how future teachers perceive their preparation for conducting early childhood mathematics education classes. The following research problems were formulated:

1. What – in a retrospective opinion – was students’ emotional attitude to mathematics classes?
2. How do future teachers assess the level of their current mathematical skills?
3. How do students value their own preparation for conducting mathematical classes in grades 1-3 after having completed practical teaching placement?
4. What students find the most difficult as far as conducting mathematics education at the early school level is concerned?

5. What factors – according to the students – contribute to a future teacher's good preparation for conducting mathematics education?
6. Do the students' own school experiences differentiate the assessment of their readiness to conduct mathematics education, and, if so – to what extent?

The method of diagnostic survey was applied in the research, making use of a questionnaire consisting of 13 questions.

The study, conducted in June 2018, involved 120 second-year students of pedagogy in the major of pre-school and early school education, studying full-time at the Faculty of Educational Studies of the University of Adam Mickiewicz in Poznan. The vast majority of respondents (89.8%) graduated from a secondary school, usually a general profile; the others are graduates of a technical secondary school. In compliance with the program of studies, the students had classes in developing mathematical competence in pre-school and early school children, comprising 15 hours of lectures and 60 hours of classes in the form of conversation lab. Moreover, they have completed 35 hours of practical teaching placement in a primary school at the first stage of education (grades 1-3).

## RESEARCH RESULTS

The effectiveness of educational interactions is diversified by the type and intensity of both student's and teacher's emotions. Therefore, the first question addressed to the surveyed students concerned the retrospective assessment of their own experiences related to learning mathematics at school.

The obtained results can be considered moderately optimistic. Although 56.7% of respondents stated that they did not like mathematics at school, 40.0% referred to it as a subject that brought joy and satisfaction. For 3.3% of respondents, learning mathematics did not imply any particular emotions; they were indifferent towards the subject. What was very frequently indicated as the reason for the reluctance towards mathematics (76.9%) was the teacher's attitude, which – according to the respondents – discouraged to work, aroused fear and stress. The respondents also indicated the wrong way of conducting classes (46.7%) – too fast a pace, the lack of support for weaker students and teachers' high requirements. Moreover, the negative attitude towards mathematics was explained by the students' failures, difficulties in understanding tasks and their teachers' conviction that mathematics is exceedingly difficult and can be mastered only by selected individuals. It was Urbańska (1985) who the problem of deformed and negative school mathematical experiences of adept teachers had already been pointed out by, and who, after having conducted research, quoted the statements of the surveyed students regarding the emotional attitude to the mathematics lesson.

They are dominated by anxiety, distance and fixed frustration towards learning the subject. It can therefore be concluded that in the Polish school a wrong, and thus ineffective way of conducting mathematics education is still maintained. Only a few students surveyed (4.2%) self-critically indicated too little commitment, lack of diligence and perseverance, and aversion to mental effort as reasons for their reluctance to mathematics. At the same time, it should be emphasized that it was the teacher and the way of conducting classes that turned out to be the basis for a positive attitude towards mathematics, inspiration for a wider interest in the subject and the source of the sense of understanding its contents.

Thus diagnosed, the teacher's clear contribution to modeling attitudes towards maths classes should set out a direction for the search for improving the methodological process of training future early school teachers, so they become a source of positive thinking about mathematics, free of fear and reluctance.

Regardless of the types and intensity of emotions accompanying students during mathematics classes in their school years, the vast majority (76.3%) define the level of their current mathematical skills and knowledge as average. An even lower level of self-assessment concerning mathematical knowledge is indicated by Seidel and Sobieszczyk (2007) in their research, according to which 75% of respondents declared only "mediocre" mathematical skills. Czajkowska (2012, p. 67) warns that "in international research, Polish students of pedagogy achieve significantly lower results in the field of mathematical knowledge and the didactics of mathematics as compared to their colleagues from other countries. Such a situation must arouse legitimate concerns about the effectiveness and correctness – especially in terms of the content – of future classes on the subject to be conducted by the students."

Further in the research, the problem of the students' self-reflection regarding their preparation for conducting mathematical classes in grades 1-3 was addressed. A factor differentiating the level of their self-esteem turned out to be the student's previous experience related to learning mathematics. Those future teachers who, as pupils, used to like maths and did not associate learning the subject with problems, proved to be much better prepared, both in terms of knowledge and methodology. 80% of students belonging to the group assess their substantive preparation as very high, and the remaining ones – as high. The methodological competences, in turn, were considered as high by the majority (64%), and 8% of respondents referred to them as very high. Those students who have faced difficulties in learning mathematics during the school years still manifest a particular reluctance towards the subject. They are concerned about their competence to conduct education in grades 1-3. 60% of respondents think that the level of their preparation in terms of knowledge is average, but there are also some (5.7%) who have indicated a low level of preparedness. Their methodological skills were evaluated slightly higher, though. A high level was indicated by the majority of respondents – 60%. However, for a large part of the group (58.8%) will find it difficult to conduct mathematics classes, and for 26.5% of them it will be even very difficult. Therefore, a conclusion can be

drawn concerning transferring the reluctance to mathematics and perceiving it as an extremely incomprehensible subject.

“Every teaching placement – according to Wenta – is prone to failures, especially in situations related to the cognitive, motivational and emotional, as well as functional and task-related areas” (Wenta, 2015, p. 21). Thus, it seems justified to make an attempt to determine what the future teachers found the most difficult while conducting mathematics education at the early school level. Possible obstacles were divided into those that appeared at the stage of preparing classes, constructing a lesson plan and while conducting a lesson.

During the preparation for the classes, the students had problems with designing teaching aids adjusted properly in terms of methodology and, above all, attractive for young learners (47% of responses). It was also found difficult to adjust the language used by the teacher in order to explain the task, instructions or introduce new mathematical issues (26% of responses). Furthermore, the respondents also pointed to difficulties in finding an interesting idea that would arouse pupils’ interest (14% of indications), selecting activating methods (11%) and planning the timing for particular activities to run a complete class (4%). Unfortunately, some students (6.7%) already felt stressed and uncertain at this preliminary stage.

Constructing a lesson plan did not constitute a problem to the students. There were individual indications (12%) concerning doubts while formulating specific objectives and setting the time frames for particular tasks. During academic classes on the subject of developing children’s mathematical competence the students learned the elements of a correct mathematics class lesson plan with particular emphasis on didactic methods and principles and the selection of appropriate didactic means.

While conducting classes, what turned out to be the most difficult for the respondents was individualizing the teaching process, activating all students, especially the more passive ones, taking into account different pace of work of each pupil. Here are a few instances of the students’ opinions: “The biggest problem I had was to focus on the entire group, and at the same time on each individually;” “Children were doing tasks at different speeds, some finished faster and became impatient while I was explaining the tasks again to the children who were «left behind.»”

What proved to be a big challenge for the students was working with a weaker learner who needed additional help and individual guidance. Some respondents (12%) indicated problems with maintaining discipline during classes, focusing students on the issues discussed and explaining subsequent tasks.

The students’ indications regarding the area of early school education which, in their opinion, turned out to be the easiest and the most difficult to carry out in the classroom, are quite divergent. Each kind of education was mentioned as both the one that causes the most and the least difficulties.

**Table 1.** The easiest and the most difficult area of early school education to be conducted in the classroom

Area of early school education	The easiest to conduct in the classroom	The most difficult to conduct in the classroom
Polish language education	46.4	21.5
Mathematics education	25.0	35.7
Art education	17.9	7.1
PE and health education	7.1	10.7
Environmental education	3.6	14.3
Musical education	0.0	10.7

**Source:** author's study.

Mathematics classes proved to be the most difficult for 35.7% of respondents, but at the same time 25% found them the easiest. A good outlook seems to be the fact that mathematical education did not dominate the area assessed as the most difficult. Both areas are dominated by Polish language and mathematical education, which proves future early school teachers' awareness of the necessity to focus on developing basic school techniques at this stage of education.

From a pragmatic point of view, what is significant are the respondents' opinions regarding the factors that make up a future teacher's good preparation for conducting mathematics education. The most important ones are as follows:

- a large number of practical classes (81.7%);
- high level of knowledge on mathematics methodology (60.0%);
- knowledge of modern didactic means appropriate for mathematical education (42.5%);
- high level of personal mathematical knowledge (35.8%);
- independent search and own teaching projects concerning classes for grades 1-3 (34.2%).

A valuable and constructive reflection among the surveyed students of the Faculty of Educational Studies at Adam Mickiewicz University is their belief in the crucial need for continuous improvement and broadening one's own competences, the need to implement lifelong learning.

## CONCLUSIONS

In the process of shaping elementary concepts and developing mathematical thinking, the earliest stage of education is very important. A young learner's encounters with mathematics often determine his or her future attitude to the subject, arouse interest and motivation to learn or (unfortunately more frequently) discourage, arouse fear and lead to school failure. Moreover, according to Urbańska (1985, p. 123): "it does matter whether a child during their first maths class will learn independent thinking, independent use of concepts, learning with understanding, or they will only focus on mechanical learning and acquiring formal skills." The youngest learners should be made aware of the fact that mathematics is not difficult, it only requires regular work and consistent exercises. This constitutes a difficult task for teachers of early school education, all the more so – according to the author's research: "pre-school and early school education students are mostly high school graduates, who received almost exclusively satisfactory grades in maths at school" (Urbańska, 1985, p. 124). Therefore, teaching mathematics to the youngest children starts from a disadvantageous position – future teachers have many unpleasant school experiences related to this subject and the level of their knowledge and skills is rather low. What should constitute support for the teacher adepts in their undoubtedly difficult profession is practical teaching placement. It is worth – following the conducted research – to encouraging students to self-observation and self-assessment after having completed the teaching placement, as these skills will turn out to be necessary for them in their pedagogical work. For future teachers must be aware that graduating from university does not mean the end of their educational path, that the acquired competences will always require extending, updating or revising, and that their development constitutes a continuous process. The significance of reflexivity and narrative nature is emphasized by Derenowski (2015, p. 49), who sees them as the indispensable qualities of a good teacher. "A reflective teacher – the author says –introduces modifications in their daily teaching behaviors more easily and is more willing to carry out self-evaluation."

The constantly changing Polish school needs teachers "following values, wise and competent professionals devoted to young people, open to their needs, aspirations, expectations and lifestyles, critical and responsible for their own actions, constantly improving their qualifications" (Denek, 2001, pp. 24-25). Such a broad set of professional competences can be effectively developed only through successive stages of a logical process of becoming a teacher. An important, and almost an indispensable part of this process are the experiences and skills acquired during well-organized (by the academic environment and schools) and effectively implemented (by the students) practical teaching placement programs.



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## MATHEMATICS IN EARLY SCHOOL EDUCATION FROM THE PERSPECTIVE OF FUTURE TEACHERS. CONCLUSIONS FROM TEACHERS TRAINEESHIP PROGRAMS

**Keywords:** early school education, teacher, integrated teaching, students traineeship programs, mathematics education

**Abstract:** The level of competence in mathematics among Polish students is insufficient, as illustrated for instance by low final examination scores in lower and upper secondary schools. Thus, it is only natural to ask questions about whether mathematics is being taught appropriately and whether adequate strategies, methods, and educational principles are being used. In this context it is necessary to ask future teachers – sophomores majoring in preschool and early school education – if they feel prepared and ready to introduce small children to the realm of mathematics. Most future practitioners of this challenging profession dislike mathematics and consider their current professional competences to be average. When assessing students' preparedness, in both substantive and methodological terms, the author found that reluctance towards mathematics and belief that mathematics is an exceptionally difficult subject are both transferrable. On a more optimistic note, the analyzed group of students are ready to further improve their professional skills through lifelong learning.

## WCZESNOSZKOLNA EDUKACJA MATEMATYCZNA Z PERSPEKTYWY PRZYSZŁYCH NAUCZYCIELI. REFLEKSJE PO PRAKTYKACH PEDAGOGICZNYCH

**Słowa kluczowe:** edukacja wczesnoszkolna, nauczyciel, nauczanie zintegrowane, praktyki studenckie, edukacja matematyczna

**Streszczenie:** Poziom kompetencji matematycznych uczniów polskich szkół nie jest zadawalający, o czym świadczą m.in. słabe wyniki egzaminów na zakończenie gimnazjum i maturalnych. Zrozumiałe są zatem pytania o (nie)poprawność prowadzenia edukacji matematycznej, o stosowanie właściwych strategii, metod i zasad dydaktycznych. W tym kontekście istotne wydaje się być poznanie opinii przyszłych nauczycieli – studentów II roku wychowania przedszkolnego i nauczania początkowego na temat ich przygotowania i gotowości do wprowadzania małych uczniów w arkana „królowej nauk”. Większość przyszłych adeptów trudnej nauczycielskiej profesji nie lubi matematyki, a swoje aktualne kompetencje merytoryczne określa jako średnie. Przy ocenie przygotowania zarówno pod względem merytorycznym, jak i metodycznym zdiagnozowano transfer niechęci do matematyki i postrzegania jej jako wyjątkowo trudnego przedmiotu. Jednakże optymizm budzi gotowość badanych studentów do podnoszenia swoich kompetencji zawodowych poprzez kształcenie ustawiczne.