DEVELOPMENT OF THE ATTITUDE TO MATHEMATICS IN FUTURE PRIMARY SCHOOL TEACHERS AS A DETERMINANT OF THEIR SELF-EFFICACY

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Abstract

Students of mathematics at the Faculty of Education have a different mathematical knowledge, ideas about the objectives of their future teaching career, skills, and attitudes to working with children, etc. Similarly, their relationship to mathematics is largely varied. We believe that the development of their relationship to mathematics at all levels of education prior to their enrolment in the Faculty of Education has a significant effect on the perception of their own self-efficacy and future educational activities. In line with the principles of self-efficacy, our assumption is that students with a positive attitude to mathematics tend to approach teaching as a challenge rather than a threat that needs to be avoided. This positive attitude to life helps future teachers develop intrinsic motivation for teaching mathematics; these teachers set stringent goals and constantly strive to achieve them.

This assumption was the basis of a research study aimed at all students of Teaching for Primary School in mathematics seminars. The quantitative part comprised the Norwegian Teacher Self-Efficacy Scale (NTSES). This questionnaire includes a seven-point Likert scale and consists of 24 items that can be divided into six sub-categories: Instruction, Adapt Instruction to Individual Needs, Motivate Students, Maintain Discipline, Cooperate with Colleagues and Parents, Cope with Change. The questionnaire was then complemented with an analysis of seminar papers on Self-Reflection of the Relationship to Mathematics, in which the students were supposed to describe their attitude to mathematics since the first encounter until their contemporary study at the Faculty of Education.

Keywords: teacher, mathematics, self-efficacy.

1 INTRODUCTION

In accordance with the current approaches to education [2] states that it is important in the work of a teacher how he/she evaluates their professional attributes, their potentials, and impact on students. It is not supposed to be an objective evaluation of the teacher or theoretical models of teacher competencies but a subjective view of the teacher of himself/herself. This attribute is normally denoted in English terminology as self-efficacy (teacher self-efficacy), in the Czech environment it is translated as perceived subjective proficiency (or perceived professional proficiency) of the teacher.

Teacher self-efficacy is a construct that was developed within the context of Bandura's social-cognitive theory. Bandura defined self-efficacy as the belief about one's own capabilities to organize and execute a certain task [1]. Self-efficacy beliefs influence thought patterns and emotions, which in turn enable or inhibit actions. According to Bandura’s theory, self-efficacy has two components: efficacy expectation and outcome expectancy. The former is the conviction that one has the ability, knowledge, and skills to successfully execute the behavior or actions required to produce the desired outcome(s). The latter represents a person’s estimate of the likely consequences (impact) of performing a task at the self-expected level of performance. That is, outcome expectancy is the belief that a given behavior or action will indeed lead to expected outcome(s). To be successful, the teacher must have both high efficacy expectations and high outcome expectancy. If the teacher has the former and not the latter, it is unlikely that the teacher will be successful teacher even if the teacher is professionally well-qualified [1].

The notion of teacher self-efficacy was first used by Bandura in the context of his social-learning theory in which he defined self-efficacy as faith in one's own ability to organize and tackle a particular task [1]. The perception of self-efficacy is influenced by thought patterns and emotions that boost or suppress subsequent actions. According to Bandura's theory self-efficacy has two main components: efficacy expectation and outcome expectancy. The first represents the belief that man has abilities, knowledge and skills to successfully take steps necessary to achieve the desired outcome. The latter component means the belief that the given behavior or act will really lead to the desired outcome. In
order for the teacher to be successful, he/she must have a high efficacy expectation and also a high outcome expectancy. If the teacher has the first but not the latter, it is very likely that he/she will not be a successful teacher, even if he/she is sufficiently qualified [1].

During the past two decades, we have witnessed a growing interest in teacher self-efficacy in Czech republic. The role of self-efficacy in teaching and learning continues to interest researchers and practitioners alike [2]. Despite using different instruments, several researchers have found that teacher self-efficacy predicts both teaching practices and student learning [6].

2 NORWEGIAN TEACHER SELF-EFFICACY SCALE IN CZECH PROSTŘEDÍ

The quantitative data were collected by Norwegian Teacher Self-Efficacy Scale (NTSES) [6]. This instrument was translated to Czech and transform into the on-line form. Originally it was created by authors Skaalvik & Skaalvik [6] for Norweign needs. They were based on the Teachers’ Sense of Efficacy Scale (TSES) [8] which is widely spread. The main reason why we have chosen this questionnaire for our research was the fact, that TSES consists only of three subscales: instructional strategies, classroom management and student engagement. Although these subscales are not identical with those in the NTSES, they are similar to instruction, keeping discipline and motivating students. The remaining NTSES subscales (adapting education to individual students’ needs, cooperating with colleagues and parents and coping with changes and challenges) are not represented as separate subscales in the TSES [6].

Finally NTSES is consisted of 24 items in the six subscales: instruction, adapting education to individual students’ needs, motivating students, keeping discipline, cooperating with colleagues and parents and coping with changes and challenges. Responses were given on a 7-point scale from not Absolutely uncertain (1) to Absolutely certain (7) [6].

Data of the qualitative approach to the given problem was collected in the form of self-reflections of 4th year students at the Faculty of Education of Palacky University (PdF UP) in Olomouc. The students were supposed to describe the development of their attitude to math since the first encounter, experience from elementary school, high school and college up to their current attitude to it. They were mainly supposed to focus on the key moments – who (or what) influenced their attitude to math, significant moments from their teaching practice, the possibilities to change their attitude, etc.

2.1 NTSES Results

49 full-time elementary school teacher program students and elementary school and special education teacher program students took part in the pilot research project in March 2017. In respect to the focus of this article we have thoroughly analyzed the last area being explored. Answers were supposed to be made on the following scale: Absolutely certain, Certain, Moderate certain, Neutral, Moderate uncertain, Uncertain, Not certain at all.

2.1.1 Successful Using of Given Instructional Methods

The first item in the given area (and 4th overall in the questionnaire) was focused on the extent of flexibility of prospective elementary school teachers toward the methods that might be recommended to them by their schools in the future: Successfully use any instructional method that the school decides to use. Chart 1 indicates that this item was assessed neutrally (41%). The placement of the other answers was around the mean value – moderate uncertain 20 %, moderate certain 23 %, certain 14 %, absolutely certain 2 %.
2.1.2 Managing Various Types of Instructions

Another item in the given area (17th overall in the questionnaire) was focused on the assessment of the extent of self-efficacy of future teaching in a class composed of various groups of students: *Manage instruction regardless of how it is organized*. Chart 2 indicates that more than 50% of all answers were positive, even if no “absolutely certain” answer was recorded. If we skip neutral assessment (22%), we can say that only 24% of students were not sure about their abilities in this item.

2.1.3 Managing Instruction under Changing of Curriculum

The following item in the given area (20th overall in the questionnaire) was focused on the extent of flexibility of prospective elementary school teachers toward changes in school educational programs: *Manage instruction even if the curriculum is changed*. Chart 3 indicates that there is a majority of positive answers again – moderate certain 31 %, certain 22 % and absolutely certain 2 %. 23 % of all answers were neutral, 20 % moderate uncertain and 2 % uncertain.
2.1.4 Well-teaching in any Given Situations

The final item in the given area and also the questionnaire was focused on the adaptation of prospective elementary school teachers to methods that would not correspond to their own choice, but still will be recommended to them: Teach well even if you are told to use instructional methods that would not be your choice. Chart 4 indicates that the assessment is again placed around the mean value – uncertain 14 %, moderate uncertain 22 %, neutral 33 %, moderate certain 27 % and certain 4 %.

3 SELF-REFLECTION OF THE RELATIONSHIP TO MATHEMATICS

If we want to avoid making past mistakes in the future, it is necessary to responsibly assess our past act. Thus, reflection can be understood as reflecting on our past act, on everything we have been through, what we have done, explanation and assessment of our past deeds. By this reflection we gain insight into the phenomena within the reach of our responsibility that have a significant influence on us or our surroundings, thus they require assessment discussion and control [5]. Nezvalová considers reflection as: “An important element of reflection is the ability to look back on our past activity, analyze it, and discover those elements that lead to positive own growth. Own experience and activity enrich theoretical knowledge and make it used. The process of reflection is a created skill and teachers should be led to its creation” ([5], p. 6 - 7).
In the Czech Republic there have been many research projects dealing with the reflections of various aspects of teaching. We were inspired by [9]. She states that based on Professor Hejný’s cue she started giving her freshman year students training to become elementary school teachers seminar works on the topic of “Self-reflection of the Attitude to Mathematics” in 2000. The task of the students was to describe their encounters with mathematics from pre-school age to the present, and try and characterize mainly the changes of their attitude to math, and elaborate on what influenced them. Students are usually taken aback, but “then, at the end of the semester, they are surprised how many experiences with math they still remember” ([9], p. 160).

In an effort to deal with the problem of self-efficacy of prospective teachers to a greater extent, we started giving similar seminar work topics to the students at the Department of Mathematics of the Faculty of Education of Palacky University in Olomouc in 2016, as we think that experience from the first encounters with mathematics and one's own school attendance continues to strongly influence subsequent self-efficacy of prospective elementary school teachers.

Our research has also rendered several common determinants that, according to the respondents' answers, directly influenced their attitude to mathematics as a school subject (be it either in a positive or negative way). In the following part we took the liberty and mentioned some direct quotes of the respondents that characterize individual parts of the answers.

3.1 Who (or what) Influenced my Attitude to Mathematics

“My attitude to mathematics was mainly influenced by my dad who helped me build my mathematical skills and predispositions since early childhood. As a little girl I loved to count colorful marbles and beads, sorted them according to their colors, and compared which heap was bigger. When I grew older, he would help me with exercises, and together with mom they would always try and explain to me everything I did not understand. I dare say that if my parents did not have such a great attitude to mathematics as they have had up to now, it would never have become my favorite subject.”

“My attitude was mostly influenced by genes that provided me with mathematical thinking after my mom. Mom in turn had inherited it from her mom... I think that heredity definitely plays an important part in this. If I did not have at least a little mathematical thinking, I would not enjoy mathematics, just like many children do not.”

“Another event that influenced my attitude was my first Mathematics Olympics when I was in middle school. Despite the fact I did not succeed much, it widened my horizons, and I felt honored just taking part in it.”

3.2 Attitude to Mathematics in Elementary School

“In first and second grade I really loved mathematics. I think that in this period mathematics was a form for me: “school as a game”. I remember we were supposed to do some exercises and when we had everything right, we stood next to our desks and got some small sweet reward.”

“Once we left elementary school and started middle school, studying mathematics was never the same again. We stopped playing and started studying.”

3.3 Attitude to Mathematics in High School

“The first thing that comes to my mind while reflecting on my prep school days is the first test we wrote. It was a geometry test. I had all the results right, but unfortunately I chose a different process than the teacher wanted us to use, so I got a bad grade. Up until that time I had never encountered such an attitude. I can say that this experience influenced my negative attitude to geometry.”

“The transition to prep school was very hard for me. My grades significantly worsened not just in math, but also in the other subjects.”

3.4 Current Attitude to Math in College

“In college I encountered more theory than calculus.”

“During my freshman year in college I was surprised. I expected of mathematics and didactics that we would be taught to teach kids mathematics. Instead of that we were taught elementary school curriculum in a much more complicated form. The same applied to my sophomore year. As late as in the third year did we start doing practical things, which I enjoy a lot more than the first two years.”
4 CONCLUSION

In accordance with the results of the pilot research we can say that prospective elementary school students feel adequately prepared to react to possible changes in the curriculum that may appear in their future teaching career. They are able to adapt to possible modifications of educational programs or working with various groups of students.

The self-reflections that were analyzed showed that students realize the importance of the teacher's personality to form the students' attitude to the given subject. They often claimed that their current attitude to math was positively or negatively influenced by the teacher (be it in elementary school or in college), and they even realize this. One respondent literally mentioned: "Of course I would like to change my attitude as I know that a teacher who does not like his/her subject negatively influences his/her students." We perceive this attitude as a basic predisposition of a successful teacher, and we want to grow it in our students in the future.

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