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PRE-SERVICE KINDERGARTEN TEACHERS' APPROACHES TO LEARNING MATHEMATICS

Eva NOVÁKOVÁ

Abstract: In the article, we present research findings focused on students' approaches to learning in mathematics subjects of the bachelor's degree in kindergarten teaching. The research was carried out on a sample of 118 students of the Faculty of Education of Masaryk University in Brno. We used the standardized SRQ-Academic questionnaire by Ryan and Connel, which was standardized for the Slovak environment. The results clearly demonstrated a minimal representation of students' intrinsic motivation to learn. Among students, external motivation to study and approaches based on the evaluation of the usefulness of acquiring the necessary competences in the basics of mathematics for their future profession prevail. Our findings are a confirmation of intuitively perceived experiences from university teaching.

Key words: preparatory education, teachers for kindergartens, mathematics, approach to learning, learning styles

1. Introduction

As at other universities preparing kindergarten teachers in the Czech Republic, the Bachelor's degree programme in kindergarten teaching at the Faculty of Education of the Masaryk University in Brno is designed as multidisciplinary. The mathematical component of the study is marginal in terms of the number of subjects in the curriculum and their scope, expressed in terms of the weekly number of teaching hours (a total of 7 teaching hours spread over 3 semesters) and credit evaluation (11 ECTS out of 180 ECTS; European Education Area). In the three compulsory courses – Development of Pre-Numerical Ideas, Development of Geometric Ideas and Didactics of Mathematics in the 1st year of Primary School – students are supposed to acquire the necessary mathematical foundation linked to themes of concrete activities, which should enable them to develop children's mathematical ideas. We consider the scope of teaching to be minimal, its focus to be appropriate to the practical needs of future teachers. However, we consider at least this minimal mathematical preparation to be necessary not only for the mathematical preliteracy of children in the narrower sense of the word, but also for the achievement of the more general goals of the pre-school curriculum and the overall personal development of children (their pre-logical thinking, general insight into the natural and cultural world).

The experience of teaching mathematical subjects at university shows that mathematics is not usually a popular subject. It is even a demotivating factor for some students. Negative beliefs about one's own mathematical competence, fear of failure, which leads to avoidance of mathematics, are often cited as the causes of this state (Nováková, 2018). In addition to the causes resulting from external influences and factors arising from students' own negative experiences with mathematics in their previous educational path, issues of motivation and learning style of the student may also influence this fact (Kuruc et al., 2020). These and other factors may be reflected in their approach to learning.

2. Theoretical background: theory of approaches to learning and learning styles

Approaches to learning (what one does in a learning situation and the rationale or explanation for why one should do it) are considered an important topic in academia. Each individual has a distinctive approach to learning that influences his or her thinking, behaviour and the way he or she processes

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information. These approaches can be distinguished according to different perspectives. There are therefore a number of definitions, interpretations and models related to this topic.

Pugnerová et al. (2020, p. 58) provide several ways of defining approaches to learning based on an analysis of the educational and psychological literature:

a) as a philosophical concept and didactic method of teaching and learning strategies, such as deepening knowledge, repetition and reconstruction, application, understanding, observation from a different perspective, and others (Dart et al., 2000),

b) in the sense of "how a student's intentions, behaviors, and study habits change based on the perception of a particular learning task" (Beyaztaş & Senemoğlu, 2015, p. 193),

c) "as the complex way in which and under what conditions students most effectively perceive, process, store in memory, and subsequently recall what they are trying to learn" (James & Gardner, 1995, p. 20),

d) as one of the factors causing differences in student performance (Kaplan & Kies, 1995),

e) as an individual learning style that is distinctive in its orientation, motivation, structure, sequence, depth and flexibility (Li et al, 2016; Witkin et al, 1977).

Mareš (1998; 2013) characterizes approaches to learning as *learning styles* and divides them into *surface, deep and strategic*. The surface learning style is usually typical of students who do not enjoy learning. They learn because they have to and want to get the learning over with quickly. This type of learning results in little or no understanding of the material and what students learn they soon forget (Kember, 2000). In the deep learning style, students are motivated to learn something new and are interested in learning. The strategic learning style is focused on getting the best grades, the performance learning style is focused on performance, students prepare according to the teacher's demands (Pugnerová et al., 2020).

According to Biggs (2007), the most successful students tend to be those who combine an in-depth and performance-oriented (strategic) approach. They are highly motivated and can use planning strategies effectively. The least successful students are those with low motivation who tend to take a surface approach. Oluremi (2015) argues that a good teacher should respect the individual learning needs of students, but absolute accommodation could be counterproductive and may not encourage the student to shift. It is generally believed that understanding students' learning styles and preferences can benefit both students and teachers. Because students learn in different ways, it seems impossible to change the learning style of every student in a group. Instead, teachers can adjust their teaching style to be in line with the learning style of their students (Awla, 2014).

Pugnerová et al. (2020) have researched the association of attitude to learning with another important factor – self-efficacy in university students. Self-efficacy as a psychological concept by Albert Bandura (Bandura, 1997) can be defined as self-confidence in one's own abilities, the belief in one's own competence or proficiency to plan and act in a manner necessary to achieve a goal, master a situation or perform a task in the broadest sense (Urbánek & Čermák,1997; Dofková, 2016).

Higher self-efficacy is positively correlated with deep approaches to learning and negatively correlated with surface approaches to learning. Individuals with higher levels of self-efficacy typically aspire to higher goals, are more persistent in their efforts, and are generally more resilient to failure (Kuruc et al., 2020).

In a deeper analysis of the learning process, a distinction is usually made between *internal* and *external motivation.* Mareš (2013), in agreement with Biggs (2007), argues that for students with higher self-efficacy, internal motivation prevails in learning, under the influence of which students try to understand and comprehend the material. The *internal motivation* is based on the needs of the person, manifested by the student's curiosity, interest and commitment to the goals even though he/she does not receive awards or praise (no external reinforcement is provided). We act on external prompting when we want to avoid an unpleasant confrontation or because we will receive a reward for achieving a given goal. In this case we speak of *external motivation.*

Kuruc et al. (2020) in their research study analysed the learning approaches – *self-regulated learning styles* – of students at three teacher training faculties in the Slovak Republic. Their aim was to create a certain picture of how self-regulation is set up and therefore also students' motivation to study. Self-regulated learning is understood by the authors as the *management of one's own learning.* The student is not only aware of *what she/he is learning*, but also *how she/he is learning* it: how she/he organises his time, whether she/he understands what she/he is learning, how she/he manages his concentration of mind, but above all *why she/he is learning*, to what end her/his learning is directed (For more detail see Kuruc et al. (2020)). Self-regulatory styles influence motivation in different ways and are linked to the social context.

3. Methods

The main aim of the research was to identify attitudes to mathematics learning and self-regulatory learning styles of kindergarten students at the Faculty of Education, Masaryk University.

We set the research question:

"What approaches to learning and self-regulated learning styles are *prevalent* among students in mathematics-focused courses?"

In our research, due to the stated aim and the formulation of the research question, we used the *questionnaire method* to obtain data, the advantage of which is the possibility of addressing a wide range of respondents. The research instrument, a questionnaire called SRQ-Academic (*Self-Regulation Questionnaire - Academic*) by Ryan and Connel from 1989, was standardized to the Slovak environment (Kuruc, 2017). The research sample consisted of a set of 2nd year full-time (N_1=76) and combined (N_2=42) students after completing mathematics courses. All the research respondents were female. Regarding their previous highest educational attainment, 25.6 % of them were graduates of secondary schools and colleges of education, 41.1 % had graduated from high school, 24.0 % had graduated from secondary schools of non-educational orientation (economics, health, etc.), and 9.3 % had a university degree. This was an absolute sample: out of 129 total students in the class, 118, i.e. 91.5 %, completed the questionnaire. The questionnaire was distributed in the Masaryk University Information System environment. The students then anonymously completed the questionnaire in printed form.

The questionnaire consisted of statements to which the student could respond on a four-point scale representing the degree of agreement with the statement (Likert scale): **1** – strongly agree, **2** –- agree, **3** – disagree, **4** – strongly disagree.

Respondents were asked the question, "Why do you work on assignments given by the teacher in mathematics seminars?"

Response menu:

1. Because I want the teacher to think that I am a good student.	**1 2 3 4**
2. Because I will have problems if I don't work.	**1 2 3 4**
3. Because I enjoy it.	**1 2 3 4**
4. Because if I didn't work, I would feel bad about myself.	**1 2 3 4**
5. Because I want to understand what I am learning.	**1 2 3 4**
6. Because that is what is expected of me.	**1 2 3 4**
7. Because doing math problems is fun.	**1 2 3 4**
8. Because it is important for me as a future teacher to do math tasks.	**1 2 3 4**

In the Slovak version of the questionnaire, which we used in our research, items 3 and 7 deal with *internal motivation.* It is based on the belief that the learning process is a natural need for humans. It is associated with a significant degree of engagement in the activity and with a feeling of satisfaction from its performance. It manifests itself in the student's curiosity, interest and commitment to

achieving goals even though he/she does not receive recognition or praise (no external reinforcement is given); the student performs tasks in order to understand things. Corresponds to a deep self-regulatory learning style.

The authors of the Slovak version of the questionnaire quote Ryan and Deci (2000) and divide external motivation into other forms of self-regulatory styles:

– external self-regulatory style (saturated by items 2 and 6): trying to avoid punishment or to get a reward. We act on an external impulse, based on a cue from another person, when we want to avoid an unpleasant confrontation. The reason for a person's behaviour is to satisfy an external demand; she/he completes the task because she/he is trying to avoid the problem,

– self-regulatory style, which is an attempt to avoid feelings of shame or guilt or to gain higher self-esteem through recognition or praise from the external environment. The individual wants to boost his/her ego, to stand out or to please someone; the student performs the task in order to enhance his/her position in the collective (self-regulation passively assumed, "introjected", saturated by items 1 and 4),

– a self-regulatory style characterized by making decisions based more on the meaning that the person attributes to the external demand. He attributes personal value to the goal and evaluates it as personally beneficial. He identifies with the activity or value, which he expresses by personally endorsing it; the student performs tasks in order to acquire the necessary competences for his future occupation ('identified' self-regulation, summarised in items 5 and 8).

4. Research results

The research provided data that we have summarized in Table 1.

Table1. *Responses to questions in the SRQ-Academic questionnaire (N = 118)*

Why do you work on assignments given by the teacher in mathematics seminars?	***1***		***2***		***3***		***4***		*Mean*
	N	%	N	%	N	%	N	%	($\bar{x}$)
1. Because I want the teacher to think that I am a good student.	10	8.47	56	47.45	40	33.90	12	10.17	2.46
2. Because I will have problems if I don't work.	20	16.95	62	52.54	29	24.58	6	5.08	2.16
3. Because I enjoy it.	8	6.78	38	32.20	65	55.08	6	5.08	2.57
4. Because if I didn't work, I would feel bad about myself.	49	41.52	59	50.00	10	8.47	0	0.00	1.67
5. Because I want to understand what I am learning.	81	68.64	35	29.66	2	1.69	0	0.0	1.33
6. Because that is what is expected of me.	32	27.12	69	58.47	16	13.56	3	2.54	1.95
7. Because doing math problems is fun.	3	2.54	40	33.90	66	55.93	9	7.63	2.69
8. Because it is important for me as a future teacher to do math tasks.	21	17.80	79	66.95	15	12.71	3	2.54	2.00

In order to evaluate the data obtained, we used only the basic statistical procedures usual for quantitative questionnaire research – the absolute and relative numbers of respondents who indicated their degree of agreement with a given statement on a four-point scale, as well as the average score ($\bar{x}$). Even from it, aware of its limitations and without claiming absolute conclusive value, some conclusions can be drawn, which we will try to formulate in our search for answers to the research question. We have visualized the frequency distribution of the respondents' answers using pie charts.

The items that could be used to infer students' intrinsic motivation for mathematics (questions 3 and 7) have very high mean scores of $\bar{x}$=2.57 and $\bar{x}$=2.69, respectively, the highest of all survey items. Only 6.78 % of the respondents strongly agree that "I enjoy it" (see Figure 1); 2.54 % strongly agree that "doing mathematics problems is fun" (see Figure 2).

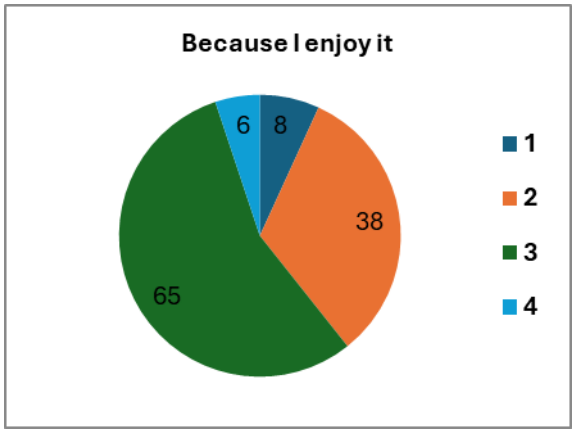


Figure 1. *Distribution of answers to the question 3*

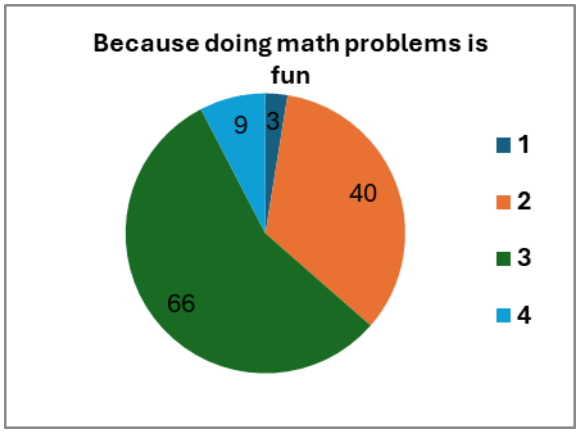


Figure 2. *Distribution of answers to the question 7*

Self-regulatory learning styles, which can be subsumed under *external motivation* to learn, are significantly dominant. The student experiences fear of his/her own failure. There is a considerable lack of confidence in one's own mathematical knowledge and abilities. 91.52 % of respondents state that "if they did not work, they would feel bad about themselves" ($\bar{x}$ = 1.67) – see Figure 3. External motivation to learn in mathematics is also expressed in other statements: 85.59 % of the respondents strongly agree or agree with the answer that they work on mathematics assignments because "it is expected of them" ($\bar{x}$=1.95); 69.49 % of the respondents because "they will have problems if they do not work" ($\bar{x}$=2.16); 55.93 % of the respondents because "they want the teacher to think they are a good student" ($\bar{x}$=2.46). The frequency of answers to questions 6, 2, and 1 can be seen from Figures 4, 5 and 6.

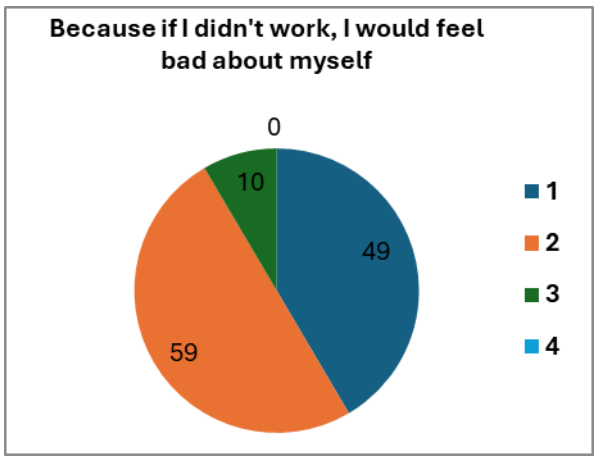


Figure 3. *Distribution of answers to the question 4*

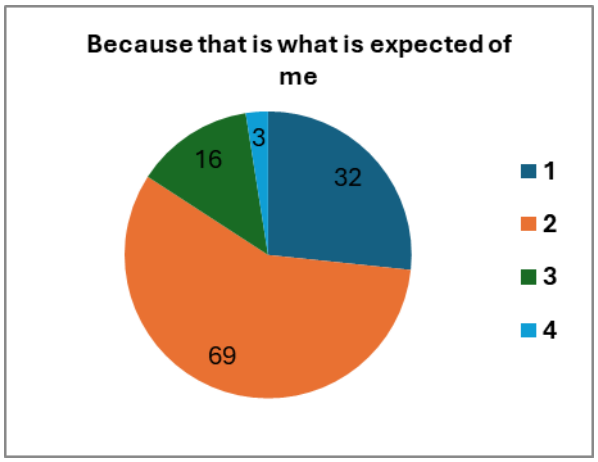
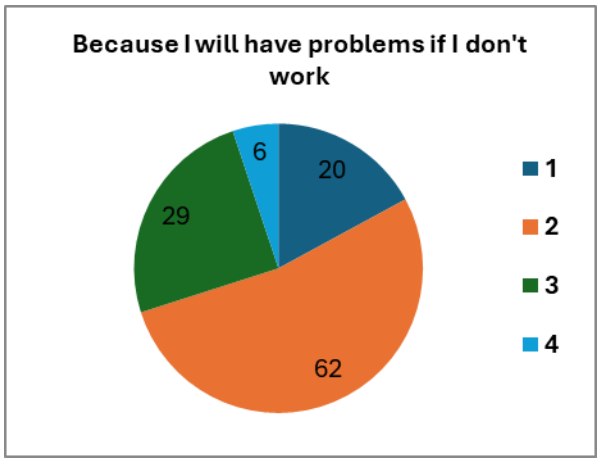


Figure 4. *Distribution of answers to the question 6*



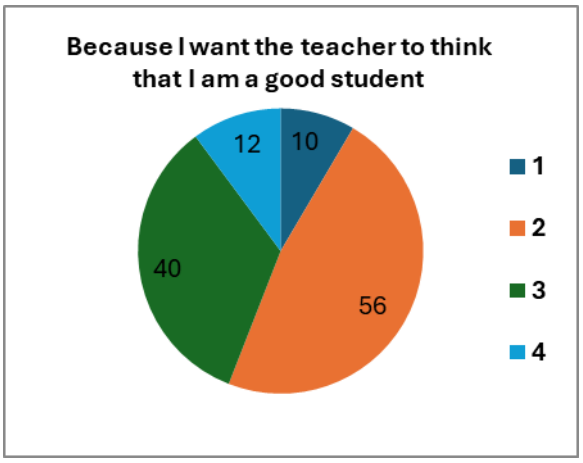
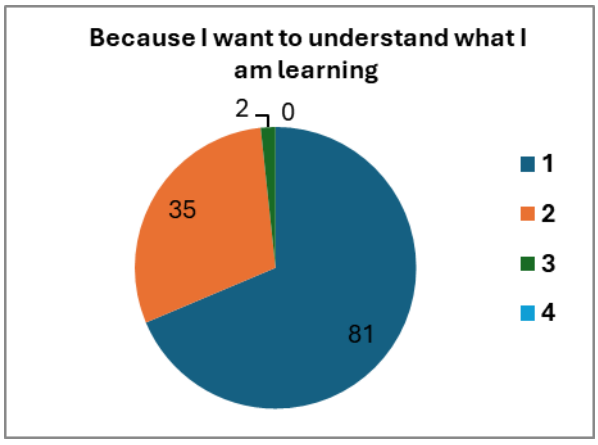


Figure 5. *Distribution of answers to the question 2*

Figure 6. *Distribution of answers to the question 1*

Encouragingly, the *identified self-regulatory learning style* (a person makes decisions based on the meaning he or she ascribes to an external demand) is strongly represented in respondents' answers: 68.64 % of respondents strongly agree and 29.66 % agree with the response "I want to understand what I am learning" ($\bar{x}$=1.33, see Figure 7) thus expressing a high degree of integration into their internal value system; 17.80 % of respondents strongly agree and 66.95 % agree that "it is important for me as a future teacher to do math tasks" ($\bar{x}$= 2.00, see Figure 8).



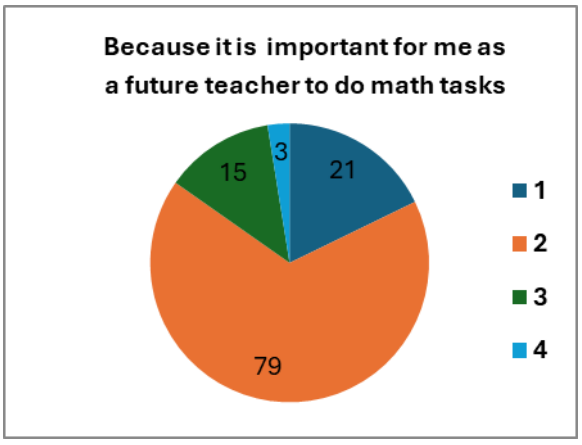


Figure 7. *Distribution of answers to the question 5*

Figure 8. *Distribution of answers to the question 8*

5. Discussions and conclusions

If we try to interpret the quantitative data obtained by our investigation, we can answer the research question quite clearly: *the results clearly showed minimal representation of internal motivation of students to learn.* Students' external motivation to learn and attitudes, usually based on the evaluation of the usefulness of acquiring the necessary competences of basic mathematics for their future profession, prevail. A positive finding *is the significant representation of the so-called identified motives*, indicating a positive perception of mathematics as a necessary component of preparation for their future profession. This fact cannot be considered surprising. Despite their mostly neutral or negative attitude towards

mathematics, students believe – or at least suspect – that mastering the necessary amount of basic mathematical knowledge can be useful in their profession (Nováková, 2018).

Our findings largely correspond with the results of research conducted at three pedagogical faculties of universities in Slovakia (Comenius University in Bratislava, Matej Bel University in Banská Bystrica and Catholic University in Ružomberok) in three groups of subjects: mathematics, science and engineering (Kuruc et al., 2020). The situation was found to be very similar for students in both pre-primary and primary education in their approaches to learning mathematical subjects, with a significant prevalence of external motivation for learning.

In our previous research (Nováková & Novák, 2019), we found that students usually do not consider further deepening their mathematical knowledge necessary for their professional development. The elementary mathematical knowledge that they believe they could use in their children's pre-math preparation in kindergarten is already sufficiently acquired in primary school: their knowledge is often implicit, "tacit" (Švec, 2012). As Žilková et al. (2015) point out, they also enter their pre-university education with many mathematical misconceptions.

In the Czech research field, research on various aspects of the mathematical component of pre-service education of kindergarten teachers is not very frequent, and this issue is still on the periphery of pedagogical researchers' attention in the Czech environment. However, the need to obtain relevant research-based data related to this aspect of kindergarten teachers' professional preparation is felt at several higher education institutions. Recently, it has found echoes, for example, in research on the attitudes of prospective teachers towards mathematics and mathematics education (Uhlířová, 2018), subjective perception of mathematics as a subject of education (Nováková, 2018), analysis of the effectiveness of activities developing mathematical preliteracy (Pěchoučková, 2013) or self-assessment of students' cognitive performance (Hnatová & Mokriš, 2019).

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Author

Eva NOVÁKOVÁ, Masaryk Univerity, Brno (Czech Republic).

E-mail: novakova@ped.muni.cz