OPEN ACCESS

EURASIA Journal of Mathematics Science and Technology Education
ISSN: 1305-8223 (online) 1305-8215 (print)
2017 13(10):6497-6508
DOI: 10.12973/eurasia.2017.01087a

Cross-National Study on Relations between Motivation for Science Courses, Pedagogy Courses and General Self-Efficacy

Andrej Šorgo
Faculty of Natural Sciences and Mathematics & Faculty of Electrical Engineering and Computer Science, University of Maribor, SLOVENIA

Vincentas Lamanauskas
Faculty of Education, University of Siauliai, Siauliai, LITHUANIA

Slavica Šimić Šašić
Department of Teachers' and Preschool Teachers' Education, University of Zadar, Zadar, CROATIA

Zehra N. Ersozlu
Graduate School of Education, The University of Western Australia, Nedlands, WA, AUSTRALIA

Iztok Tomažič
Biotechnical Faculty, University of Ljubljana, Ljubljana, SLOVENIA

Milan Kubiatko
Faculty of Humanities, University of Žilina, SLOVAKIA

Pavol Prokop
Faculty of Education, Trnava University, Trnava & Institute of Zoology, Bratislava, SLOVAKIA

Alpay Ersozlu
Graduate School of Education, The University of Western Australia, Nedlands, WA, AUSTRALIA

Jana Fančovičova
Faculty of Education, Trnava University, Trnava, SLOVAKIA

Martin Bilek
Faculty of Education, Charles University, Prague, CZECH REPUBLIC

Muhammet Usak
Science Education Research Center, TURKEY

Received 1 April 2017 ▪ Revised 7 August 2017 ▪ Accepted 15 September 2017

ABSTRACT

1799 prospective elementary and prospective science teachers from six countries (Croatia, Czech Republic, Lithuania, Slovakia, Slovenia and Turkey) participate in the study about the level of motivation toward science courses, pedagogy courses and self-efficacy. The most important findings were that choosing educational career as the first choice of prospective teachers depends on country and study track. The highest percentage of prospective teachers who choose teaching career and will probably stay teachers is in participating institutions from Slovenia and Croatia and the lowest in Slovakia and Turkey with Czech Republic and Lithuania in between. The percentages are higher for prospective elementary teachers than for prospective science teachers. Motivation of prospective teachers' regarding to the science courses and pedagogy courses vary. Differences between countries are small but as a rule future science teachers are more motivated for science courses than for pedagogy/didactics courses and the opposite is true for elementary

Correspondence: Andrej Šorgo, *Faculty of Natural Sciences and Mathematics & Faculty of Electrical Engineering and Computer Science, University of Maribor, SLOVENIA*
andrej.sorgo@um.si

teachers. Differences on general self-efficacy beliefs vary within and between countries? On average values falls in the upper third range what can be predictor of good teaching. Correlation between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs is statistically significant but low, showing that good students are generally motivated for all courses but differences between motivation toward science and pedagogy exists and depends on study track. Conclusion of our study is that science teachers are better equipped to cope with problems than elementary teachers, but elementary teachers will most probably work at the working place they choose as their first will.

Keywords: motivation level, pedagogical content knowledge, prospective science teachers, prospective elementary teachers, self-efficacy, comparative analysis, educational career, self-efficacy beliefs, science education

Contribution of this paper to the literature

- More than half of the prospective elementary teachers and less than half of the prospective science teachers declared that teacher education was their first study choice.
- There are some general trends but differences between countries are large and calls for more detailed studies within each country.
- Elementary teachers want to become teachers from the beginning and for them science is only one course among other courses. On the other hands, prospective science teachers are interested in science on the first place and teaching is only one of the options to work in the field of science.

INTRODUCTION

Science education is challenged by a society in many ways. Our civilization depends on a supply of professionals of disciplines rooted in science and technology, and many global problems (e. g. global warming; depletion of resources; loss of biodiversity; pollution) emerged where cooperation and understanding between science and social sciences and humanities is a must. All of this calls for first-class science education for all with a science and scientific literate citizen in mind as a general goal of such education. Development of science and scientifically competent citizens should start as early as primary or at least at elementary school level what calls for appropriately educated and motivated teachers at all school levels (Driver, Newton & Osborne, 2000; Kolsto, 2001, Sinatra, Kienhues, & Hofer, 2014). As a consequence, the important question becomes whether the same teaching methods and strategies toward increase of popularity and science and scientific literacy can be used internationally or whether every entity should develop these strategies individually. Van Driel Beijaard, and Verloop (2001) argue that teacher education reform efforts in the past were usually unsuccessful because they failed to take teachers' existing knowledge, beliefs, and attitudes into account (Bryan, 2003). Consequently, conceptions of good science teaching can remain unchanged throughout teacher education (Skamp and Mueller, 2001; Nadelson, Callahan, Pyke, Hay, Dance, & Pfiester, 2013, Ryan, Kuusinen, & Bedoya-Skoog, 2015).

Contemporary science teachers are confronted with many challenges. From a teacher perspective, it is expected to simultaneously prepare students to be successful at the high stakes exams and be competent lifelong learners who are going to solve interdisciplinary problems. Teachers must be able to follow trends such as changes in students, development of cognitive sciences, penetration of ICT in every pore of the society, growing body of knowledge in every discipline, and be able to balance between local and global important educational issues. To make things even more worrying and opposite to the needs of a society (Millar, 1996) young people's interest in entering science and engineering careers is dropping in many countries worldwide (Osborne, Simon, & Collins, 2003; Feinstein, Allen, & Jenkins, 2013; DeWitt, Osborne, Archer, Dillon, Willis, & Wong, 2013). It is granted that good teaching is based on good teachers and what teachers actually do in a classroom is most relevant to student learning (Kennedy, 2010; Hiebert, & Morris, 2012). It is well known that teachers' personal characteristics in a

combination of situational characteristics and content knowledge and craft-skills affect achievements of their students (Brophy, 1986; Shulman, 1986, 1987; Kennedy 2010). Among a plethora of different internal and external factors, motivation (Skinner & Belmont, 1993) and self-efficacy (Soodak & Podell, 1996; Bandura, 1993, 1997) were recognized by many (Sutton & Wheatley, 2003; Canrinus, Helms-Lorenz, Beijaard, Buitink, & Hofman, 2012) as the most important interconnected factors influencing teaching.

PCK (Pedagogical Content Knowledge) has been identified as an important component of teachers' professional knowledge. PCK is defined as the blend of knowledge of content to be taught and knowledge of pedagogy that results in teachers' understanding of how the teaching content can be best organized, adapted, and presented to students of diverse abilities and interests (Shulman, 1987). The notion of PCK was first introduced by Shulman (1986, 1987) and viewed as "teachers' ways of representing and formulating the subject-matter knowledge in the context of facilitating student learning". According to Shulman (1986, 1987), PCK refers to an understanding of the interplay between pedagogy/didactics and content. Thus, teachers need to possess pedagogical content knowledge in order to teach in an effective way. For instance, a science teacher teaching cell biology need to know both what the concept of cell structure is (content knowledge), and how this particular concept could be integrated into the lesson plan (pedagogical knowledge). In other words, the knowledge teachers need to possess is not a general idea of pedagogy or content knowledge; rather, it is the knowledge of pedagogy that is specific to a particular subject matter. Teachers with PCK can transform their subject matter knowledge into teachable content knowledge (Geddis, Onslow, Beynon, & Oesch, 1993; Usak, Ozden, & Eilks, 2011; Van Driel,, & Berry, 2012; Wahbeh, & Abd-El-Khalick, 2014).

According to Bandura (1997), modelling represents one of the main sources of information for self-efficacy appraisal. Students who observe peers who successfully perform a task can be more certain that they, too, are capable of accomplishing that task. As a consequence, the achievement of those students is higher. Self-efficacy therefore refers to beliefs about one's capabilities to learn or act in a certain way. Bandura also presents other sources of information in addition to vicarious-observational experience (modelling), which can contribute to the construction of self-efficacy beliefs. Those sources of information are: enactive mastery experiences, verbal persuasion and physiological and affective states.

Why people do what they do, is the question that the motivation theorists try to answer for many years. Despite the difficulties in defining the concept of motivation, most authors agree that motivation is an internal state that drives behavior and defines its direction, intensity and duration (Huitt, 2011, Glynn, Taasoobshirazi, & Brickman, 2007, 2009). By Pastuović (1999) motivation is defined as a psychological process of satisfying the needs and motives of the individual. Motives can be internal states of the organism (needs, cognition and emotion) and/or external stimuli. When asked what motivates people for certain behavior, content theories of motivation give an answer. They are older and more numerous, less abstract and closer to the experience and are therefore more popular (drive-reduction theory, need theories, incentive theory etc.). However, process theories of motivation provide an answer to the question of which elements people decide to take some action (Pastuović, 1999). Theoretical explanation of educational motivation takes structure of the model from the process theories of motivation, and a knowledge of human needs that govern the behavior of the content theories of motivation, because education is ''only a form of behavior that learn other behaviors for successful achievement of various goals, and they in turn satisfy different needs'' (Pastuović, 1999, 291).

In the field of education, the authors distinguish the general and specific motivation for learning. The general motivation for learning is permanent and broad disposition that manifests itself as a desire to acquire knowledge and skills in different learning situations, while the specific motivation relates to students' motivation for adoption of content in a given school area (Vizek Vidović, Vlahović-Štetić, Rijavec, & Miljković, 2003). The general motivation is stable, its source is in the student and depends on his/her experiences with school and learning, while specific motivation depends mostly on external factors, such as the behavior of teachers and content that is learned, and therefore it may be easier to change a variety of teaching strategies.

There are two reasons why motivation is important in education. On the one hand, the motivation is viewed as a key determinant of learning and academic achievement, because more motivated students invest more

effort and persist longer in academic tasks than students who are less motivated (Pintrich, & Schunk, 1996). On the other hand, the second biggest problem faced by teachers is precisely students' lack of motivation to learn (Vizek Vidovic et al., 2003).

In cognitive model of motivation, efforts and persistence in learning largely depend on a variety of beliefs, attitudes and perceptions of students (Weiner, 1990). Students' beliefs about the value of content and skills they are learning and beliefs about self-efficacy are factors that explain students' motivation. The task value, which reflects students' beliefs about content that is perceived as useful, important and attractive by the students, have proved to be related to students' behavior. For example, students who valued math skills more often go to additional classes in math than students who did not value the math skills (Wigfield & Eccles, 1992). Goals theories usually distinguish three types of goal orientations: the orientation to learning, orientation on performance and orientation on work avoidance (Niemivira, 1996; Liem et al., 2008), which determine the behavior of students in learning. Students focusing on learning want to improve their skills and understanding of the subject, students focusing on performance tend to demonstrate their high ability and to get positive assessment from the other, while students orienting to avoid the effort to learn invest less effort. These motivational orientations show different relationships with self-regulated learning and academic achievement. Beliefs about self-efficacy refers to students' beliefs about their own abilities that they can successfully perform a task (Bandura, 1997). Students with higher self-efficacy set higher goals, invest more effort and persist longer in the face with difficulties than students with lower self-efficacy. Zimmerman (2000) believes that self-efficacy is basic motive for learning and beliefs about self-efficacy are sensitive to subtle changes in the context of learning, interacting with the processes of self-regulation of learning and to mediate students' academic success.

Purpose of the Study

The purpose of the present study is to examine prospective teachers' level of motivation toward science and pedagogy-related courses and also analyse relationship between students' motivation and their self-efficacy beliefs in six countries. Research questions were as follows:

1. Is educational career the first choice of prospective teachers?
2. How do prospective teachers' motivation vary with regard to the subjects (science courses and pedagogy courses)?
3. How do prospective teachers' self-efficacy beliefs vary?
4. Is there any relationship between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs?

The results are going to be used as a baseline in improvement of teacher candidates' courses in participating institutions.

METHODOLOGY OF RESEARCH

Quantitative methods with questionnaires as the research instruments were used.

Sample and Sampling

Sample consisted of 1799 prospective teachers (596 males, 1203 females) enrolled in various departments (elementary school teaching and science teaching) in selected universities in Croatia, Czech Republic, Lithuania, Slovakia, Slovenia and Turkey.

The questionnaire based on instruments developed by Schwarzer, & Jerusalem (1995) and Glynn, Taasoobshirazi, & Brickman (2007, 2009) was compiled in English language and translated into the Croatian, Czech, Lithuanian, Slovakian, Slovenian and Turkish languages.

The questionnaire was administrated in a paper and pencil form to the participants in the summer semester of 2010 – 2011 academic year. Participation was voluntary and anonymity of the participants was

guaranteed. Questionnaires were administered prior or after the lessons by teaching staff. Collected data were filled in spreadsheet files in each country and merged in a master-file used for later statistical analyses. Initial data were cleared and items with large missing parts were removed from the pool.

Distribution of the participants across to the countries are as follows; Croatia 165 (9.2%, Czech Republic 458 (25.5%), Lithuania 427 (23.7%), Slovakia 103 (5.7%), Slovenia 310 (17.2%), and Turkey 336 (18.7%). Of all the participants, 962 (53.5%) were prospective elementary school teachers and 837 (46.5%) were prospective teachers of science or different science subjects (Biology, Chemistry, Physics). Ratio between elementary school teachers and science teachers varies between countries: e.g. Croatia 127 (77.0%): 38 (23.0%); Czech Republic 267 (58.3%): 191 (41.7%), Lithuania 180 (42.2%): 247 (57.8%); Slovakia -only prospective science teachers were in sample- 103(5.7%), Slovenia 143 (45.1%): 167 (53.9%), and Turkey 245 (72.9%): 91 (27.1%).

Data Collection Instrument

To address the first research question, whether educational career is prospective teachers' first choice, two questionnaire items were provided. The first was *'Teacher education was my first study choice'*, and the second was *'If given a chance I would prefer a job in non-educational enterprise.* They were given the chance to respond by circling 'yes' or 'no'. In the analysis, differences between countries are examined.

The second research question was 'how prospective teachers' motivation varies with regard to the classes that the subjects take (science courses and pedagogy courses) in six countries. In the analysis, differences between countries are examined. Science Motivation Questionnaire (SMQ) developed by Glynn, Taasoobshirazi & Brickman, (2007, 2009) with 30 items on a five point Likert type scale was used to examine motivation toward science and pedagogy/didactic courses. This instrument was designed as two separate forms. The difference between two forms was that in the first questionnaire (SMQ) the word science was used and in the second questionnaire (Pedagogy/Didactics Motivation Questionnaire – PMQ) it was replaced by a pair of words pedagogy /didactics. An example is a pair of statements: "I enjoy learning science", and "I enjoy learning pedagogy/didactics". Each of the instruments have the same instructions. Only the words science and pedagogy/didactics are changed. Respondents had to cross checkboxes on the scale: Never (1); Rarely (2); Sometimes (3); Usually (4); Always (5). For the purpose of statistical analyses they get values in parentheses.

In the context of building PCK (Shulman, 1987) interest was in differences between motivation toward science and motivation toward pedagogy/didactics. The differences between science and pedagogy/didactics motivation are presented as difference between means (Msc – Mped) and effect size calculated as Cohen's d (Nakagawa & Cuthill, 2009). Positive values of Cohen's d and the differences between means (**Table 4**) indicate that prospective teachers are more motivated for science courses than for pedagogy/didactics courses. The opposite is true for negative values.

Self-efficacy was measured using General Self-Efficacy Scale (Schwarzer, & Jerusalem, 1995). The General Self-Efficacy Scale is a 10-item psychometric scale that is designed to assess optimistic self-beliefs. The language versions available at the Frei University of Berlin's website (http://userpage.fu-berlin.de/~health/selfscal.htm) were used in the study. Response format is 1 = Not at all true; 2 = Hardly true; 3 = Moderately true; 4 = Exactly true.

Analysis

Prior to further analysis, data set was firstly subjected to descriptive statistics for checking missing case analysis and outliers. Additionally, data were also checked for normality using Kolmogorov – Smirnoff test at 0.05 significance level. All variables followed normal distribution, which allowed to test differences with parametric tests. Differences between means in individual items and between countries were tested by ANOVA. The differences between science and pedagogy/didactics motivation are presented as difference between means and as effect size calculated as Cohen's d (Nakagawa & Cuthill, 2007). Reliability of the questionnaires were tested by using Cronbach's alpha.

Reliability of the science motivation questionnaire (SMQ) expressed as Cronbach's alpha is 0.87. Reliability of the pedagogy/ didactics motivation questionnaire (PMQ) expressed as Cronbach's alpha is 0.91. Both values can be recognized as very good. Reliability of the self-efficacy scale is 0.77, what can be recognized as good.

RESULTS OF RESEARCH

Prospective Teachers' Choice of Teaching Profession

Table 1. Frequencies of responses concerning the statement 'Teacher education was my first study choice.' (N / %)

		Slovenia	Croatia	Czech Republic	Lithuania	Turkey	Slovakia	Total
Yes	N / %	243/79.2	106/65.0	277/60.5	191/44.7	124/36.9	32/31.1	973/54.2
No	N / %	64/20.8	57/35.0	181/39.5	236/55.3	212/63.1	71/68.9	821/45.8
Total	N	307	163	458	427	336	103	1794

As seen in the **Table 1** differences among the countries concerning the statement 'Teacher education was my first study choice.' were high ranging from 79.2 % positive answers in Slovenia to 31.1 % in Slovakia. Big differences exist between elementary school teachers and subject teachers. Among 959 prospective elementary teachers 615 (64.1%) declared that teacher education was their first study choice, the statement supported by only 358 (42.9%) of 835 prospective science teachers. Additionally, there are statistically significant differences in answers (values of χ^2 not presented) within countries, with the exception of Turkey where (χ^2 (1 336) = 0.705; p = 0.393) and Slovakia where only prospective science teachers are in the sample. The highest percentages of prospective elementary teachers who choose teaching profession as their first study choice are in Slovenia (87.9%), followed by Croatia (73.8%), Czech (71.2%), Lithuania (64.4%) and Turkey (37.6%).

Percentages of prospective science teachers who choose teaching profession as their first study choice are lower in all countries. The highest percentage of such prospective teachers are in Slovenia (71.7%). In all other countries (Czech (45.5%), Turkey (35.2%), Croatia (35.1%), Slovakia, 31.1%, and Lithuania (30.4%)) less than half of the prospective science teachers' study at faculties by their first choice.

Table 2. Frequencies of responses concerning the statement 'If given a chance I would prefer a job in non-educational enterprise' (N / %)

		Slovakia	Turkey	Czech Republic	Lithuania	Croatia	Slovenia	Total
Yes	N / %	90/87.4	293/87.2	264/57.6	189/44.3	54/32.9	87/28.4	977/54.5
No	N / %	13/12.6	43/12.8	194/42.4	238/55.7	110/67.1	219/71.6	817/45.5
Total	Total	103	336	458	427	164	306	1794

As presented in **Table 2**, the highest number of prospective teachers who are not planning to drop out from the educational career path at first suitable chance is in Slovenia (71.6%) and Croatia (67.1%). At the tail are Slovakian (12.6%) and Turkey prospective teachers (12.8%). There exists a difference between future elementary teachers where 55.9% are planning to stay teachers for the whole career. Among subject teachers there are only 33.7% teachers with such plans. Differences between elementary and science teachers exists within and between countries. Situation is the worst in Turkey where 88.6% prospective elementary and 83.5% prospective science teachers (χ2 (1 336) = 0.269; p = 0.147) is going to choose option to drop from teaching career. Among prospective elementary teachers the most optimistic situation is in Slovenia where only 2.9% will prefer career outside schools, followed by Croatia (22.0%), Lithuania (28.9%), and Czech Republic (45.7%). For Slovakia, we do not have such data. Completely different situation was found in prospective science teachers. Half or more than half of the subject teachers who will prefer teaching career is only in Czech (64.3%) and Slovenian (50%) sample. In all other countries teaching career is not the first choice. Results are as follows: Lithuania (55.5%), Croatia (70.3%), Slovakia (87.4%) and Turkey (88.6%).

Correlation between both statements (r = 0.392) is statistically significant (p = 0.01), however low, showing that lifelong teaching career is most probably a choice only for someone who had chosen his/her career in teaching as a first choice.

Prospective Teachers' Motivation to Learn Science Courses and Pedagogy Courses

Table 3. Differences between countries on motivation on science courses and motivation on pedagogy/didactics courses. Results are sorted by effect size. (MSc = motivation toward science courses; Mped = motivation toward pedagogy/didactics courses)

Country	N	Msc	SD	Mped	SD	Msc - Mped	Effect size
Lithuania	427	3.52	0.51	3.27	0.65	0.25	0.42
Slovenia	310	3.31	0.43	3.17	0.43	0.14	0.31
Slovakia	103	3.36	0.39	3.20	0.49	0.14	0.32
Czech Republic	458	3.36	0.39	3.32	0.52	0.04	0.10
Turkey	336	3.42	0.42	3.43	0.49	-0.01	-0.02
Croatia	165	3.15	0.53	3.41	0.62	-0.26	-0.46
Total	1799	3.38	0.45	3.31	0.55	0.07	0.15

Differences among countries (**Table 3**) are not statistically significant for both, science and pedagogy didactics instruments in all items except items 'I use strategies that ensure I learn the science well' (p = 0.026), and 'It is my fault, if I do not understand the science' (p = 0.015) in the science questionnaire.

Total motivation scores for science course is the highest in Lithuania (M = 3.52; SD = 0.51) and the lowest in Croatia (M = 3.15; SD = .53). Total motivation score for pedagogy/didactics course is the highest in Turkey (M = 3.43: SD =.49) and Croatia (M = 3.41; SD = 0.62) and the lowest in Slovenia (M = 3.17; .SD = 43). The results on both instruments are above median in all countries and differences among countries are small.

Values of effect size drops in the category of insignificant (below 0.2) to small (0.2 – 0.5) in all countries. Nevertheless, one can recognize that differences between samples exists, however they can be biased by a ratio of elementary and science teachers in samples from different countries.

Table 4. Differences between prospective elementary and prospective science teachers on motivation on science courses and motivation on pedagogy/didactics courses. (MSc = motivation toward science courses; Mped = motivation toward pedagogy/didactics courses)

Study track	N	Msc	Std	Mped	Std	Msc - Mped	Effect size
Elementary school teachers	962	3.20	.47	3.47	0.46	-0.15	-0.38
Subject teachers	837	3.46	.43	3.13	0.59	0.34	0.66
Total	1799	3.38	0.45	3.31	0.55	0.07	0.15

From the **Table 4** it is clearly seen a difference between prospective elementary and science teachers. While the prospective elementary teachers seemed to be more motivated in pedagogy/didactics and less in science the opposite was true for prospective science teachers where difference is close to large effect size (Cohen's d = 0.66).

Prospective Teachers' Self Efficacy Beliefs

Differences among countries on self-efficacy instrument are statistically significant (F (5, 1797) = 32.16; p <0.001). Values are presented in **Table 5**. Difference between prospective elementary school teachers and science teacher was not statistically significant (p = 0.086) with regard to self-efficacy beliefs. Values for elementary teachers were M= 30.56, SD = 4.34 and M = 30.92, SD = 4.65 for science teachers, and calculated effect size d =0.08, respectively. In both cases individual sums were in whole range from 10 to 40. From the high value of SD one can

Table 5. Differences between countries on General Self-Efficacy Scale

Country	N	Mean	SD	Min.	Max.
Slovenia	310	32.38	3.497	21	40
Croatia	165	31.74	5.006	12	40
Turkey	336	31.30	4.399	10	40
Lithuania	427	31.04	4.486	10	40
Czech Republic	458	28.96	4.263	16	40
Slovakia	102	28.77	4.501	10	40
Total	1798	30.72	4.493	10	40

conclude, that dispersion of results is big, so we cannot handle prospective teachers as a uniform group regarding self-efficacy.

The Relationship between Students' Motivation to Learn and their Self–Efficacy Beliefs

Table 6. Correlations between Science motivation, Pedagogy/ didactics motivation, and self-efficacy

	Pedagogy / didactics motivation	Self-efficacy
Science motivation	0.384	0.222
Pedagogy/ didactics motivation		0.118

All results are statistically significant at the p = 0.000 level (two tailed)

As presented in **Table 6** it can be recognized that relationship using pooled data revealed positive, statistically significant and moderate correlations. The highest correlation (r = 0.384) was between motivation for science and pedagogy/didactics motivation, showing that general trend was that students were motivated/unmotivated for both components of teaching. Self-efficacy was better connected with science courses than with pedagogy/didactics courses.

DISCUSSION

Results of present study opened more questions than giving answers concerning prospective science teachers motivation toward their future careers, motivation for study and their self-efficacy. There are some general trends but differences between countries are large and calls for more detailed studies within each country.

Prospective Teachers' Choice of Teaching Profession

From the results presented in **Tables 1** and **2** the first recognized problem can be recruitment of the future elementary teachers in most of the participating countries. When trying to answer question of whether educational career is the first choice of prospective elementary teachers, results can be regarded as satisfactory only in Slovenia, where for 87.9% of the respondents teaching career was their first choice. The situation can be regarded as unsatisfactory in other countries and further studies about underlying factors are needed. The situation is much worse in all countries when we are looking at prospective science teachers. With exception of Slovenia (71,7%) in all other countries less than half of the prospective science teachers' study at faculties by their first choice.

Worrying is the finding about the high number of pre-service teachers for whom teaching career will not be the first choice (**Table 2**). The highest number of prospective teachers who are not planning to drop out from the educational career path at first suitable chance is in Slovenia (71.6%). At the tail are Slovakian (12.6%) and Turkish prospective teachers (12.8%). This finding can be alarming for both countries. From the results of the present study the problem of the recruitment of the future teachers candidates can be outlined. The ideal situation is when teachers are recruited from a pool of high school students with teaching career as their main choice. It can be speculated that in the future teachers who choose teaching as their first study choice will be more motivated in a classroom than someone who has different aspirations. According to results of present study closer to such situation

are only in Slovenia. In fact, study choices offered in Slovenia in elementary and science education far exceed number of prospective students who want to elect these studies. As a result, most of the students who enter educational tracks seem to choose these tracks according to their preference and not because of lack of options. On the other hand because of limited selection teachers are at least partially recruited by lower achievement students rejected by some other faculty, a problem already recognized in Slovenia (Tomažič, & Vidic, 2009). The unanswered problem is how to attract larger number of higher achievers based on their grades on external exams (Tomažič, & Vidic, 2009). The opposite situation is in other participating countries especially in Turkey and Slovakia, where it seems that teaching and teaching career is not the first reason to enter educational study tracks. The reasons for such situation cannot be figured out from the results of our study. Socio-economic reasons for choosing teaching profession probably exists, but cannot be evaluated from the data of our study.

Prospective Teachers' Motivation to Learn Science Courses and Pedagogy Courses

The results on both instruments measuring motivation toward science (SMQ) and pedagogy (PMQ) courses (**Table 3** and **Table 4**) are above median in all countries and differences between countries are small. The results can be seen as optimistic, but they are not satisfactory, so further actions should be taken to raise motivation on science and pedagogy/didactics courses in all participating countries.

Values of effect size representing a difference between SMQ and PMQ drops in the category of small (Nakagawa, & Cuthill, 2009) nevertheless one can recognize that differences exists. In the first group, there are Lithuanian, Slovenian and Slovakian students, where motivation for science exceeds motivation for pedagogy/didactics. In the second group there are Czech and Turkish students, where differences between motivations are small. A separate group are Croatian students where motivation for pedagogy/didactics courses is higher than motivation for science course. If pedagogy/didactics knowledge is regarded as of similar importance than content knowledge in the context of PCK (Shulman, 1987) than serious measurements should be taken to rise motivation toward pedagogy/didactics courses, especially in Slovenia and Slovakia, and in raising motivation toward science in Croatian students.

Additionally, the differences on motivation can be recognized between prospective elementary and prospective science teachers (**Table 4**). The first seemed to be more motivated in pedagogy courses and the second in science courses. The differences probably arise from two sources. Future elementary teachers know from the very beginning that they are going to teach a rainbow of topics in a range of singing or painting to the math and grammar at the other end. As a result, their general interest is more on teaching than on teaching some specific topics. On the contrary, the interest of science teachers was more on science than on pedagogic/didactics. In building reasonable basis for development of PCK on science issues, elementary teachers should be motivated more on science, and science teachers on pedagogic/didactics. Socio-scientific issues and connection of theoretical science contents with practical every-day issues can be an approach to better teaching (Holbrook, & Rannikmae, 2007; Albe, 2008). More emphasis is need for raising interest and motivation in science at the elementary and lower secondary teachers levels. Reasons are many and exposed are only two of them. Inappropriate educated elementary and lower secondary school teachers are a probable source of misconceptions, which are hard to eliminate at the upper levels. In addition, they are possible distracters for their students who are searching their field of interest in science and/or technics (Ploj Virtič, & Šorgo, 2016). Knowing that student interest toward science is formed in early education, action is need to raise motivation toward science in early educators. Also knowing that secondary school students' interest in science decline by every additional year of science courses, resulting in decline of interest to enter university science, technology and engineering programmes.

Prospective Teachers' Self Efficacy Beliefs

Differences among countries on self-efficacy instrument are statistically significant (F (5, 1797) = 32.16; p <0.001). Values are presented in Self efficacy (**Table 5**). Good news are that high values on self-efficacy scale is regarded as one of the crucial factors for good teaching (Day, Elliot, & Kington, 2008). On average, most of the teachers from our sample falls into the upper third group on the general self-efficacy scale what can be regarded as

optimistic. Differences between countries are not so big to be alarming, but worth mentioning is that the most optimistic are Slovenian students, where nobody falls below 21 points and students from Czech Republic where nobody falls below 16 points. From the high values of SD one can conclude that results are dispersed, so one can find on the courses students with high and low level of self-efficacy and most of them falling in between. From the practical point of view and future career it can only mean that teachers who are going to disperse to the schools are different according self-efficacy. Especially these with low scores are probably going to need help and a lot of support during the courses and later at their working places.

The Relationship between Students' Motivation to Learn and their Self–Efficacy Beliefs

As presented in **Table 6** it can be recognized that relationship using pooled data revealed positive, statistically significant and moderate correlations. The highest correlation (r = 0.384) is between motivation for science and pedagogy/didactics motivation, showing that general trend was that students were motivated/unmotivated for both components of PCK. The results reveal that there is probably a connection between motivation to study or to be a good student regardless of course but motivation toward courses can be higher or lower. Self-efficacy was better connected with science courses than with pedagogy/didactics courses. Speculation is that science teachers are better equipped to cope with problems than elementary teachers. Open stays question if this finding is connected with the age of children with whom prospective teachers will be working and differences in the nature of work. Elementary teachers works with younger student, teaching them a variety of contents, so in that sense, they maybe feel less efficient. On the other hand correlations are low and do not allow to connect motivation for university courses and general self-efficacy without reserve. The findings are only partially in line with findings of other authors who connects self-efficacy with others predictors of successful school work (e.g. Zimmerman, 2000, Margolis & McCabe, 2006).

CONCLUSIONS

Choosing educational career as the first choice of prospective teachers depends on country and study track. The highest percentage of prospective teachers who choose teaching career and will probably stay teachers is in participating institutions from Slovenia and Croatia and the lowest in Slovakia and Turkey with Czech Republic and Lithuania in between. The percentages are higher for prospective elementary teachers than for prospective science teachers. From the study cannot be revealed about the reasons, but are most probably a mixture of study opportunities and socio-economic status of the participants. Especially in Turkey and Slovakia findings calls for measurements to make teacher profession more attractive.

Motivation of prospective teachers' regard to the science courses and pedagogy courses vary. Differences between countries are small but as a rule future science teachers are more motivated for science courses than for pedagogy/didactics courses and the opposite is true for elementary teachers. Interpretation is that elementary teachers wants to become teachers from the beginning and for them science is only one course among other courses. On the other hands, prospective science teachers are interested in science on the first place and teaching is only one of the options to work in the field of science.

Differences on general self-efficacy beliefs vary within and between countries? On average values falls in the upper third range what can be predictor of good teaching.

Correlation between students' motivation toward science courses, pedagogy courses and their self-efficacy beliefs is statistically significant but low, showing that good students are generally motivated for all courses but differences between motivation toward science and pedagogy exists and depends on study track. Conclusion of our study is that science teachers are better equipped to cope with problems than elementary teachers.

REFERENCES

Albe, V. (2008). When scientific knowledge, daily life experience, epistemological and social considerations intersect: students' argumentation in group discussions on a socio-scientific issue. *Research in Science Education*, *38*(1), 67-90.

Bandura, A. (1993). Perceived self-efficacy in cognitive-development and functioning. *Educational Psychologist*, *28*(2), 117-148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.

Brophy, J. (1986). Teacher Influences on Student-Achievement. *American Psychologist, 41*(10), 1069-1077.

Bryan, L. A. (2003). Nestedness of beliefs: examining a prospective elementary teacher's belief system about science teaching and learning. *Journal of Research in Science Teaching, 40*(9), 835–868.

Canrinus, E. T., Helms-Lorenz, M., Beijaard, D., Buitink, J., & Hofman, A. (2012). Self-efficacy, job satisfaction, motivation and commitment: exploring the relationships between indicators of teachers' professional identity. *European journal of psychology of education*, *27*(1), 115-132.

Day, C., Elliot, B., & Kington, A. (2005). Reform, standards and teacher identity: challenges of sustaining commitment. *Teaching and Teacher Education*, *21*(5), 563-577.

DeWitt, J., Osborne, J., Archer, L., Dillon, J., Willis, B., & Wong, B. (2013). Young children's aspirations in science: The unequivocal, the uncertain and the unthinkable. *International Journal of Science Education*, *35*(6), 1037-1063.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, *84*(3), 287-312.

Feinstein, N. W., Allen, S., & Jenkins, E. (2013). Outside the pipeline: Reimagining science education for nonscientists. *Science*, *340*(6130), 314-317.

Geddis, A. N., Onslow, B., Beynon, C., & Oesch, J. (1993). Transforming content knowledge: Learning to teach about isotopes. *Science Education*, 77, 575–591.

Glynn S. M., Taasoobshirazi, G., & Brickman, P. (2007). Nonscience majors learning science: A theoretical model of motivation. *Journal of Research in Science Teaching*, *44*(8), 1088-1107.

Glynn S. M., Taasoobshirazi, G., & Brickman, P. (2009). Science motivation questionnaire: construct validation with nonscience majors. *Journal of Research in Science Teaching*, *46*(2), 127-146.

Hiebert, J., & Morris, A. K. (2012). Teaching, rather than teachers, as a path toward improving classroom instruction. *Journal of Teacher Education*, *63*(2), 92-102.

Holbrook, J., & Rannikmae, M. (2007). The nature of science education for enhancing scientific literacy. *International Journal of Science Education*, *29*(11), 1347-1362.

Huitt, W. (2011). Motivation to learn: an overview. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. Retrieved 2.1.2012. from http://www.edpsycinteractive.org/topics/motivation/motivate.html

Kennedy, M. M. (2010). Attribution error and the quest for teacher quality. *Educational Researcher*, *39*(8), 591-598.

Kolsto, S. D. (2001). Scientific literacy for citizenship: Tools for dealing with the science dimension of controversial socioscientific issues. *Science Education*, *85*(3), 291-310.

Liem, A.D., Lau, S., & Nie, Y. (2008). The role of self-efficacy, task value, and achievement goals in predicting learning strategies, task disengagement, peer relationship, and achievement outcome. *Contemporary Educational Psychology*, *33*, 486–512.

Margolis, H., & McCabe, P. P. (2006). Improving self-efficacy and motivation: What to do, what to say. *Intervention in School and Clinic*, *41*(4), 218-227.

Millar, R. (1996). Towards a science curriculum for public understanding. *School Science Review*, 77(280), 7-18.

Nadelson, L. S., Callahan, J., Pyke, P., Hay, A., Dance, M., & Pfiester, J. (2013). Teacher STEM perception and preparation: Inquiry-based STEM professional development for elementary teachers. *The Journal of Educational Research*, *106*(2), 157-168.

Nakagawa, S., & Cuthill, I. C. Effect size, confidence interval and statistical significance: a practical guide for biologists. *Biological Reviews*, *82*(4), 591-605.

Niemivirta, M. (1996). Motivational-cognitive components in self-regulated learning. *Paper presented at the "5th International conference on Motivation", Landau, Germany*.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: a review of the literature and its implications. *International Journal of Science Education*, *25*(9), 1049-1079.

Pastuović, N. (1999). *Edukologija [Educology]*. Zagreb: Znamen.

Pintrich, P., & Schunk, D. (1996). *Motivation in education: Theory, research & applications*. Englewood Cliffs, NJ: Merrill/Prentice Hall.

Ploj Virtič, M., & Šorgo, A. (2016). Can we expect to recruit future engineers among students who have never repaired a toy? *Eurasia Journal of Mathematics, Science & Technology Education*, *12*(2), 249-266.

Ryan, A. M., Kuusinen, C. M., & Bedoya-Skoog, A. (2015). Managing peer relations: A dimension of teacher self-efficacy that varies between elementary and middle school teachers and is associated with observed classroom quality. *Contemporary Educational Psychology*, *41*, 147-156.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35-37). Windsor, England: NFER-NELSON.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15(*2), 4-14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Sinatra, G. M., Kienhues, D., & Hofer, B. K. (2014). Addressing challenges to public understanding of science: Epistemic cognition, motivated reasoning, and conceptual change. *Educational Psychologist*, *49*(2), 123-138.

Skamp, K., & Mueller, A. (2001). Student teachers' conceptions about effective primary science teaching: A longitudinal study. *International Journal of Science Education*, *23*(4), 331-351.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom - Reciprocal effects of teacher-behavior and student engagement across the school year. *Journal of Educational Psychology*, *85*(4), 571-581.

Soodak, L. C., & Podell, D. M (1996). Teacher efficacy: Toward the understanding of a multi-faceted construct. *Teaching and Teacher Education*, *12*(4), 401-411.

Sutton, R. E., & Wheatley, K. F. (2003). Teachers' emotions and teaching: A review of the literature and directions for future research. *Educational Psychology Review*, *15*(4), 327-358.

van Driel, J, H., Beijaard, D., & Verloop, N. (2001) Professional development and reform in science education: the role of teachers' practical knowledge. *Journal of research in science teaching, 38*(2), 137-158.

Van Driel, J. H., & Berry, A. (2012). Teacher professional development focusing on pedagogical content knowledge. *Educational Researcher*, *41*(1), 26-28.

Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., & Miljković, D. (2003). *Psihologija obrazovanja [Psychology of education]*. Zagreb: IEP-VERN.

Wahbeh, N., & Abd-El-Khalick, F. (2014). Revisiting the Translation of Nature of Science Understandings into Instructional Practice: Teachers' nature of science pedagogical content knowledge. *International Journal of Science Education*, *36*(3), 425-466.

Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology*, *82*(4), 616-622.

Wigfield, A. & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review*, *12*, 265-310.

Zimmerman, B. J. (2000). Self-Efficacy: An essential motive to learn. *Contemporary Educational Psychology, 25*, 82–91.