international journal of Current innovations in Interdisiplinary Scientific Studies

Volume 2, Issue 1, (2018) 01-09

Innovation in professional training within the future teachers' preparation

Kvetoslav Bartek [a *], Palacky University, Faculty of Education, Department of Mathematics, Zizkovo nam. 5, Olomouc, Czech Republic

Eva Bartkova [b], Palacky University, Faculty of Education, Department of Mathematics, Zizkovo nam. 5, Olomouc, Czech Republic

Suggested Citation:

Bartek K. & Bartkova E. (2018). Innovation in professional training within the future teachers' preparation. international journal of Current innovations in Interdisciplinary Scientific Studies. *2*(1), 01-09.

Received from August 02, 2018; revised from September 10, 2018; accepted from December 16, 2018.
Selection and peer review under responsibility of Prof. Dr. Huseyin Uzunboylu, Near East University, Cyprus.

Abstract

The paper is aimed at an analysis of the educational needs of Primary school teacher training students of the Faculty of Education, Department of mathematics. The purpose of the analysis was to identify the educational needs of the students with respect to their mathematical and didactic competencies, examine the under-training students' knowledge in other fields such as psychology, and to encourage innovation in pedagogical activities . The data were obtained by the means of a non-standardized questionnaire assigned to them. The questionnaire comprised 20 items, which could be categorized into three basic groups - teachers' subject-specific content knowledge, subject-specific pedagogical content knowledge and subject-unspecific psychological-pedagogical content knowledge. The questionnaire was handed out to 116 first-year students and to 44 students in the second year of the Primary school teacher training study program. The results of the study proved that final year students were more open to innovating their own pedagocical activities than first year students. The research recommends ways of providing adequate training to primary school teacher trainees, at the end of this research.

Keywords: educational needs, primary school ,teacher training, mathematics,innovation, pedagogy

* ADDRESS FOR CORRESPONDENCE: Kvetoslav Bartek, Palacky University, Faculty of Education, Department of Mathematics, Zizkovo nam. 5, Olomouc, Czech Republic
E-mail address: kvetoslav.bartek@upol.cz / Tel.: +42-058-563-5036

1. Introduction

Mathematics, as a subject of study, was introduced into the educational curriculum because of its ability to develop the art of critical thinking and problem solving in students (Yildirim, Tarim, & Ilfazoglu, 2006). Yildirim et al. (2006) further explained that the skills that mathematics develops in students, such as the ability to think through problems and the ability to develop solutions to problems is a necessity for daily life activities. Deringol (2018) however explained that an individual's anxiety towards mathematics could affect their performance on the subject negatively. It is therefore necessary that teachers detect these anxiety problems and help students to overcome it, in order for them to learn the necessary skills from the subject.

In a study by Refugio, Galleto, and Torres, (2019), the number of years of experience that a teacher has, plays a role in the flexibility of their teaching method. Teachers who have taught for a longer period are more flexible, more innovative and tend to know how to deal with student complexities in studying. Roxas (2015) also explained that teachers that are flexible in their teaching style are better teachers of mathematics.

Every student is different and learning style is different for every student (Canpolat, 2019). A student's perception of their own ability to grasp what they are being taught determines largely their success in learning. Academic self-efficacy, as it was termed by Canpolat (2019), influences a student's ability to learn. Canpolat (2019) recommended that the learning environment in schools should support academic self-efficacy, by teachers varying the teaching method.

From previous studies, it is evident that a student's attitude towards a course determines their success in the particular course. When a student has academic self-efficacy, they are not anxious of mathematics as a subject. They are therefore more likely to perform better than students who do not have academic self-efficacy. The learning environment can however help students to be academic self –efficient with the introduction of various resources and pedagogy in teaching. The teacher plays a major role in helping students learn better. By applying innovative teaching methods and paying attention to every student's needs, no student will be left out.

Several studies have been carried out in a bid to understand how mathematics can be taught to students. Previous studies concentrated mostly on the factors affecting students learning. Other studies also concentrated on the role of the teacher in helping students learn better. There is however, a gap in research on how mathematics teachers can be trained to teach mathematics to students while simultaneously diagnosing learning disorders or other factors that slows the learning process in students.

In the years 2011 and 2014, the Department of Mathematics at Palacky University Faculty of Education had been dealing with an analysis of the educational needs of Primary school teacher training with respect to their mathematical and didactic competencies. The research sought to examine the under-training students' knowledge in other fields such as psychology, apart from their original field of study, which was mathematics. The study also aimed to ascertain the under-training teachers' ability to recognize learning disorders in students and innovate their own pedagogical teaching method that would improve their future primary school students' ability to learn mathematics.

The data were partly obtained by the means of a non-standardized questionnaire assigned to the students.

2. Methodology

The student's educational need was analyzed with the help of a questionnaire. The research used a questionnaire focused on the usefulness of the professional training within the future teachers'

pregraduate preparation (compiled by Kalhous & Horak., 1996), which we slightly modified to serve the purposes of our research. It comprised 20 items. Items of the modified questionnaire could be categorized into three basic groups (Shulman, 1986; Hill, Rowan & Ball, 2005; Kunter et al., 2013):

1. Teachers' subject-specific content knowledge – deep understanding of the content to be taught (i1, i2, i3).
2. Subject-specific pedagogical content knowledge – necessary to transfer the content to students (i4, i5, i7, i9, i10, i11, i13, i16, i18 and i19).
3. Subject-unspecific psychological-pedagogical content knowledge – generic, cross-curricular knowledge needed to create and optimize teaching and learning situations (i6, i8, i12, i14, i15, i17 and i20).

The questionnaire was handed out to 116 first-year students and to 44 students in the second year of the Primary school teacher training study program. In total, there were 160 participants to this research. The students were asked to assess the usefulness of the given skills (knowledge) in their future occupation i.e. that of a primary school teacher of mathematics. This was carried out on the basis of their personal experiences, assumed knowledge, thoughts and feelings connected with their dealing with mathematics as a school subject in the role of a pupil on the one hand, and their being taught mathematics within the framework of the didactic preparation on the other hand.

3. Analysis of the students' educational needs through an investigation questionnaire

The assessment was to be carried out by ticking one of the numbers on a 5-degree scale, whereas number 1 meant topmost quality, number 2 quality, 3 relative quality, 4 no quality, 5 absolute lack of quality, N – unable to assess).

Chart No 1 for the 1st and 2nd year students

i1) Mastery of technical elements of mathematics.

i2) Appropriate use of the mathematical terminology and symbols.

i3) Ability to solve a learning task in mathematics.

i4) Ability to manage the pupils' activities connected with solving a learning task in mathematics.

i5) Ability to formulate (create) learning tasks in mathematics in compliance with the teaching goals.

i6) Ability to compile a quality didactic test in mathematics.

i7) Ability to set the educational goals.

i8) Ability to motivate a pupil in an appropriate way.

i9) Ability to work with the material didactic instruments (teaching aids, computers).

i10) Ability to assess a textbook used in teaching mathematics.

i11) Acquaintance with and ability to use adequate teaching methods.

i12) Ability to asses a pupil's performance.

i13) Ability to identify the internal as well as the external conditions making for an effective learning of mathematics on the side of the pupil.

i14) Understanding the necessity of a permanent self-education in mathematics and its realization in practice.

i15) Awareness of the most widespread learning disabilities (dyscalculia) and ability to deal with them.

i16) Ability to recognize a mathematically gifted pupil and to develop his/her gift.

i17) Ability to make on the spot decisions regarding typical as well as unusual pedagogical situations.

i18) Ability to project (plan) one's own pedagogical activities.

i19) Awareness of the alternative didactic procedures and ability to apply them.

i20) Ability to communicate with the pupils.

4. Findings

To illustrate the selected sample of students, we attached here under a chart, demonstrating the response rate across the sample. On the first line, labelled *valid*, the number of the students having answered the particular question is stated. On the *missing* line, on the other hand, the number of the students, who for one reason or another did not respond to the particular item of the questionnaire or did not feel competent to assess the extent to which a certain ability might be important for their future job, is stated.

Chart No 2: Response rate across the sample

Σ	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i18	i19	i20
Valid	159	160	159	154	154	157	155	158	160	153	155	157	148	156	154	157	157	157	156	98
Missing	1	0	1	6	6	3	5	2	0	7	5	3	12	4	6	3	3	3	4	0

The chart makes it obvious that with some items, students had no difficulties considering the level of necessity of the given abilities for their future job. This is true for the following abilities:
i2) Appropriate use of the mathematical terminology and symbols,
i9) Ability to work with the material didactic instruments (teaching aids, computers),
i20) Ability to communicate with the pupils.

Possibly also:
i1) Mastery of technical elements of mathematics,
i3) Ability to solve a learning task in mathematics,
i8) Ability to motivate a pupil in an appropriate way.

All of these may be regarded as the premises about the basic abilities and competencies every teacher should dispose of. However, it coming to other premises, a large amount of the students found it impossible to respond. They were as follows:
i10) Ability to assess a textbook used in teaching mathematics,
i13) Ability to identify the intern as well as the extern conditions making for an effective learning of mathematics on the side of the pupil.

In our opinion, the reason why some students chose the *N* answer in response to these premises probably has to do with their limited professional experience, possibly as a result of limited knowledge

in the given area of interest, which is demonstrated by the chart below, showing the response rate in particular years of study.

Chart No 3 response rate across the whole sample

1st year	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i18	i19	i20
Valid	116	116	115	111	111	114	112	115	116	109	111	113	104	112	110	113	113	113	112	116
Missing	0	0	1	5	5	2	4	1	0	7	5	3	12	4	6	3	3	3	4	0

Chart No 4 response rate across the whole sample

2nd year	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10	i11	i12	i13	i14	i15	i16	i17	i18	i19	i20
Valid	43	44	44	43	43	43	43	43	44	44	44	44	44	44	44	44	44	44	44	44
Missing	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0

The results show that as students climb through the academic ladder, they acquire more knowledge through their studies and the ability to shape one's opinion grows.

Let us have a more detailed look at the structure of the responses:

Chart No 5. Response rate in percent

		of topmost quality	of quality	of relative quality	of no quality	absolute lack of quality	unable to assess
i1	1st year	39,66	39,66	17,23	3,45	0	0
	2nd year	22,73	43,18	29,55	2,27	0	2,27
i2	1st year	25,87	45,69	23,27	5,17	0	0
	2nd year	29,55	40,91	25	4,55	0	0
i3	1st year	50,86	36,21	10,34	1,73	0	0,86
	2nd year	47,73	40,91	11,36	0	0	0
i4	1st year	54,31	30,17	9,48	1,73	0	4,31
	2nd year	68,18	20,45	6,82	2,27	0	2,27
i5	1st year	25	41,38	24,14	5,17	0	4,31
	2nd year	40,91	38,64	13,64	4,55	0	2,27
i6	1st year	31,9	45,69	19,82	0,86	0	1,73
	2nd year	63,64	25	6,82	2,27	0	2,27
i7	1st year	37,93	38,79	16,38	3,45	0	3,45
	2nd year	43,18	34,09	13,64	6,82	0	2,27
i8	1st year	77,59	15,52	5,17	0,86	0	0,86
	2nd year	79,55	13,64	2,27	2,27	0	2,27
i9	1st year	42,24	43,97	12,93	0,86	0	0
	2nd year	63,64	27,27	9,09	0	0	0
i10	1st year	12,93	44,83	31,04	4,31	0,86	6,03
	2nd year	13,64	43,18	36,36	6,82	0	0
i11	1st year	43,96	37,07	12,07	2,59	0	4,31
	2nd year	43,18	52,27	4,55	0	0	0
i12	1st year	67,24	24,14	5,17	0,86	0	2,59
	2nd year	81,82	18,18	0	0	0	0
i13	1st year	20,69	44,83	22,41	1,73	0	10,34
	2nd year	36,36	47,73	11,36	4,55	0	0
i14	1st year	11,21	53,45	26,72	5,17	0	3,45
	2nd year	6,82	54,55	34,09	4,55	0	0
i15	1st year	40,52	33,62	15,51	3,45	1,73	5,17
	2nd year	68,18	13,64	15,91	2,27	0	0
i16	1st year	37,07	38,79	18,1	3,45	0	2,59
	2nd year	50	36,36	13,64	0	0	0
i17	1st year	44,83	42,24	9,48	0,86	0	2,59
	2nd year	52,27	43,18	4,55	0	0	0
i18	1st year	41,38	45,69	10,34	0	0	2,59
	2nd year	56,82	34,09	9,09	0	0	0
i19	1st year	10,34	55,17	25,87	5,17	0	3,45
	2nd year	29,55	45,45	25	0	0	0
i20	1st year	86,2	11,21	2,59	0	0	0
	2nd year	95,45	4,55	0	0	0	0

The table shows that with all items (except items 1, 3, 11 and 14), students in higher years tend to prefer new skills and knowledge which they acquired in the course of their studies and which they had not run across before.

5. Discussion

The results of the study exhibits the educational need of students of Primary school teacher training program in the Department of Mathematics at Palacky University Faculty of Education. From the results of the study, the major problems faced by primary school teacher –trainees, especially those in their first years are "the ability to identify the internal as the external conditions making for an effective learning of mathematics on the side of the pupil" and "the ability to assess a textbook used in teaching mathematics". The reason for this was because students in their first year had limited knowledge in psychology and the art of reading into student problems. This can be attributed to their lack of professional experience. Final year students on the other hand did not have a problem in this regard.

Final year students appreciate the acquisition of new skills and knowledge as compared to first year students. This is evident in the results of the study. With the exception of i1, i3, i11 and i14, all other responses to the items in the questionnaire proved that final year students were more open to learning new things. Final year students are more open to new ideas, new fields and challenges. This also means that the best time in introducing other fields of study into the educational curricula would be in their final years.

A very interesting phenomenon also is the increase in the number of respondents who do not believe it necessary to dispose of technical knowledge. This quite precisely illustrates the current situation in the education at the final year. While the first year students believed it was essential to learn the technical knowledge in the art of teaching mathematics, final year students believed that they do not require any deepening of the existing technical knowledge, which, according to them, will be of no use in their job and which they consider sufficient. At the same time, they emphasize deficiencies in other areas. They also regard further progress in mathematics coming with every other year of studies of less importance. The results for the subject unspecific items on the questionnaire (i6, i8, i12, i14, i15.i17 and i20) all exhibited how final year students were more opened to infuse knowledge from other fields of studies, especially in psychology into their methods of teaching. They believed it was necessary to know other factors that influence students' ability to learn and also to find the best way of motivating students to learn.

Item 15 (i15) was one of the items that this research was very interested in. The question addressed the ability of teacher training students to recognize learning disability in students and how it can be dealt with. The results proved that most first year students found it difficult to recognize dyscalculia in students. Final year students however could recognize learning disabilities and could deal with it. Teachers should address learning disability if they want all their pupils to benefit from their teaching. If teachers do not recognize dyscalculia, the student would miss their chance to study. Mathematics is a necessity for every individual and no one should be allowed to miss on it because of a psychological defect.

The research also looked at innovation in teaching. Two items on the questionnaire addressed students' innovative abilities. Item 17 (i17) measured students ability to be innovative with regards to making on-the spot decisions on typical as well as pedagogical situations. Majority of final year students felt that they had the ability to make spot on decisions. More than one-third of first year students also felt that they had the ability to make spot-on decisions on teaching pedagogical situations. However, majority of the first year students lacked the ability to be innovative.

With regards to item 18 (i18), which measured students' ability to plan or project their own pedagogical activities, students in their first year were not innovative enough. Final year students on the other hand, felt confident to project their own pedagogical activities. Taking a more detailed look at the results of the research, it is evident that, even though the final year students felt they had the ability to project their own pedagogy in teaching, most of them still needed their abilities to be sharpened. Mathematics is a subject that needs its teachers to be innovative, in order to carry all the students along in the learning process. It is therefore necessary that teachers of mathematics are innovative in their teaching methods.

6. Conclusions

The research sought to analyze the educational needs of the students with respect to their mathematical and didactic competencies, examine the under-training students' knowledge in other fields such as psychology, and to encourage innovation in pedagogical activities. The basis for the analysis of the educational needs was a didactic test, assigned to the 1st and 2nd year students of Primary school teacher training study program. Our aim was to get the students acquainted with some tasks primary school pupils solve in the 5th grade, right from the start of their studies. Their own performance helped the students realize the necessity of self-training, of an independent logical thinking, and of developing confidence in one's own abilities. It is through the analysis of investigation questionnaires and of the tests' results that we acquire valuable information, which enable us to identify the educational needs of the students.

Based on "Teachers' subject-specific content knowledge," first year students did not have much knowledge but were willing to study. Final year students however had knowledge on technical aspects of their courses but were not interested in acquiring advanced technical knowledge because they felt it was not needed in their jobs. This issue needs to be addressed because students irrespective of the number of years of study should be open to gaining advanced knowledge in their field. They may not need to teach their pupils advanced mathematics, but they need it to enable them increase their depth of understanding in the subject, which would help them communicate better with their students. It is therefore necessary to encourage acquisition of advanced technical knowledge in students at all levels.

The second category of the items on the questionnaire was "Subject-specific pedagogical content knowledge." The major need of students under this category was i10 and i13. Most first year students did not have the topmost quality of assessing a textbook, which may possibly be due to limited knowledge in their field of study. Students also lacked the ability to identify internal and external factors that affects student's ability to learn. Which meant they lacked pedagogical ability. These are underlying activities that every good teacher should be capable of doing. They are therefore in need of subject specific pedagogical training. Students however believed they could project their own pedagogical activities. It would be much easier for students to project their own pedagogical activities, if they are already acquainted with existing pedagogical activities.

The third category focused on "Subject-unspecific psychological-pedagogical content knowledge." When it comes to the psychology and student's ability to identify dyscalculia pupils, first year students were not confident in their ability to identify and help pupils with such conditions. Final year students however, had the ability to identify and help such students. A critical look at the responses, it is evident that final year students still need psychology classes as well. From the results however, the teacher training students did not have a problem with motivating students to learn. The students also had no problem with innovating and projecting their own pedagogical ideas.

From the results, it is evident that the primary school teacher training program students need training in all the three categories that this research sought to investigate. Final year students need more of enlightenment to understand the benefit of teach advanced technical topics in their field and they also need psychology classes to understand their students. First year students, in addition to the need of the final year students, require additional training in subject specific and subject-unspecific areas. This would increase their knowledge and help them to offer better training for their future pupil. This research therefore recommends a tweak in the training method for the under training teacher.

References:

Canpolat, A. M. (2019). The relationship between academic self-efficacy, learning styles and epistemological Beliefs: A Study on the Students of the School of Physical Education and Sports. *Cypriot Journal of Educational Science*. 14(4), 610–617.

Deringol, Y. (2018). Primary school students' mathematics motivation and anxieties. *Cypriot Journal of Educational Science*. 13(4), 537–548.

Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal. 42.* 371-406*.*

Kalhous, Z., Horak, F. (1996). K aktualním problémům začínajících učitelů. *Pedagogika, 46*(3), 245 - 255.

Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T. & Hachfeld, A. (2013). Proffesional competence of teachers: effects on instructional quality and student development. *Journal of Educational Psychology, 105*(3), 805-820.

Refugio, C., Galleto, P. & Torres, R. (2019). Competence landscape of grade 9 mathematics teachers: Basis for an enhancement program. Cypriot Journal of Educational Science. 14(2), 241-256.

Roxas, A. V (2015). Teaching Competencies of Mathematics Professors in Higher Education Institutions (HEIs) In the Province Of Capiz: Basis for Instructional Enhancement Program.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*, 4-21.

Yildirim, K., Tarim K. & Ilfazoglu, A. (2006). The effects of cooperative learning within A multiple intelligence framework on academic achievement and retention in maths. *Journal of Theory and Practice in Education*, 2(2), 81–96