

Chemistry Teachers' Training in Slovakia

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Abstract

The lecture contains basic information about situation in preparation of students of universities for a job of a teacher of chemistry and also about preparation of current teachers of chemistry at elementary schools and at high schools. The lecture explains the main problems in preparation of future teachers according to problems resulting from the situation in teaching natural sciences. In initial teacher training part we provide a list of universities which prepare future teachers and in in-service teacher training part we provide a list of national projects which have been accomplished in Slovakia during the last 5 years. Their aim was to prepare future teachers of chemistry and also current teachers for modern, open, flexible and good educational system. The lecture names main problems and barriers in preparation of future teachers and current teachers of chemistry in teaching, approaches of students of universities and their possible solutions.

1. Initial Teacher Training

The most influential factor which influences working of scholar system is quality of teachers. Inferior teacher cannot provide good education even when all of the conditions for teaching are provided. On the contrary a good teacher can compensate worse conditions of educational process. The quality of teachers depends on selection of applicants for studying teaching and on providing possibilities for teachers to professional and personal development. Providing of a good selection and preparation for teaching is in a competence of vocational schools, grammar schools and mainly in competence of universities. The Science subjects as physics, chemistry, biology, math and geography are not the favorite ones and students classify them as difficult and they do not choose them for their future study. Despite this fact there are teachers who can motivate students for their future study of chemistry or other science subjects. Problems in preparation of future teachers of chemistry are:

- Retreat from an experiment at elementary schools and high schools
- Lowering the amount of lessons of science subjects
- Missing laboratories and special classrooms at many elementary schools and high schools
- In the last 20 years there is still insufficient amount of good teachers of science subjects, there is 80% of teachers who are older than 50 years
- Disinterest of young people to study and do teaching (no financial motivation and very bad working conditions – average wage of a teacher of elementary school at Slovakia is 580 EUR per month and at high school 680 EUR per month)

We have 11 universities at Slovakia, which prepare future teachers on the bachelor level BSc. and master level Mgr., from those 7 universities prepare future teachers of chemistry for ISCED 2 and ISCED 3 mainly on scientific faculties (UK Bratislava, UKF Nitra, UMB Banská Bystrica, UPJŠ Košice) and pedagogical faculties (TU Trnava, KU Ružomberok, UJŠ Komárno – only BSc. level). Study programs on each university differ even though there are perennial efforts for uniform attitude in preparation of scientific teachers

It is needed to say that there is insufficient amount of applicants for studying teaching, mainly in scientific subjects. Almost half of the applicants come from grammar schools, the rest from vocational schools but also from secondary vocational schools and those are mainly students who got only average or below average results or they consider studying of teaching as something temporary because they were not successful at non-teaching subject departments.

For the improvement of the selection of applicants for the job of a teacher and their preparation it is needed to increase attractivity of teaching. In the process of selection it is needed to focus on the most successful students of high schools, work out the professional standards and improve the preparation for teaching, provide sufficient pedagogical practice at training schools (average duration of



pedagogical practice in Slovakia is 6 weeks).

2. In-service Teacher Training

On the Faculty of Natural Sciences at UK in Bratislava there is the Department of Natural Sciences, Psychology and Education which prepares future teachers. It is the creator and leader in many national and international projects since 1999. In these projects are applied experiences and results from researches and are used in innovative preparation of teachers of chemistry, biology, geography and environmental studies. It gradually offers new optional subjects to students in which they can spread their portfolio of knowledge but also can get new competences in teaching. Those are, for example, The Art of Presentation and Communication, Activating Methods and their Use in Teaching, Tools of Motivation in Teaching Chemistry. Other optional subjects focus on work with digital technologies, for example, Work with Interactive Board, Didactic Software for Teaching Science Subjects, Mobile Science Education, Creation of Webpages. Other faculties also try to improve the study by incorporating attractive subjects into study plans.

On the basis of our years of experience from the work on the national projects (Infovek, Modernizácia vzdelávania na ZŠ a SŠ, Moderný učiteľ, etc.) we decided to work out the project for **Identification of Innovative Teachers of Scientific Subjects** in Slovakia and connect the work of innovative teachers with preparation of future teachers of scientific subjects on Faculty of Natural Sciences UK, Department of Education. That is how project KEGA “**Incubator of Innovative Teachers of Scientific Subjects at Elementary and High Schools**” was created. The aim of this project is to create a database of teachers who create the basis of innovative teachers with whose help the reform of education “from below” will be implemented (new methods and forms of education with support of digital technologies) and also education for teachers for improvement of creativity at schools. It is also needed to implement inevitable change in preparation of future teachers of scientific subjects at universities.

For fulfilling of the aims of Incubator of Innovative Teachers it is needed to:

- Identify innovative teachers of scientific subjects
- Analyze didactic performances of innovative teachers and create a database of innovative teachers of scientific subjects, which will present a mass of innovative teachers of elementary schools and high schools in Slovakia
- Connect the work of innovative teachers with the preparation of future teachers of scientific subjects at universities and create a system of “Innovative Semesters of Science Didactics” where seminars, workshops of innovative education, creative discussion and closer cooperation of Bsc. students and Mgr. students with innovative teachers will take place
- Create a webpage of the project where the work of innovative teachers will be presented (performances from innovative semesters of science didactics, photo and video documentation of the project and other innovative activities of Department of Natural Sciences, Psychology and Education Faculty of Natural Sciences, UK.
- In the final year of the project (2014) it is our aim to work out a publication which should be involved in basic literature for the university preparation of future teachers of scientific subjects and for education of teachers, for the need of implementing innovative and creative forms of work at elementary schools and high schools.

During the winter semester of academic year 2012/2013 from September to December was accomplished “**1. Innovative Semester of Teaching Science Education in Chemistry, Biology and Geography for future teachers as well as for teaching subjects and psychology**”. Eight innovative teachers led in winter semester eight lectures, six seminars and three workshops. There were two teachers invited for each subject. Innovative teachers discussed the progress and the scenario of their activities connected with bachelor and master program of teacher training. From activities of each innovative teachers the didactic materials, video of the activity, short interesting videos and photo documentation were chosen.

During the summer semester took place “**2. Innovative Semester of Teaching Science Education in Chemistry, Biology and Geography for future teachers as well as for teaching subjects and psychology**”. Nine innovative teachers who led nine lectures, seven seminars and one workshop were invited. There were again created innovative methodic materials, photo and video documentation. All the performances are at the portal: <http://inkubatorucitelov.eskola.sk/>. Students



evaluated invited innovative teachers after each innovative semester. Their reactions were very positive. We want to point out the interesting trends which happened during the realization period of innovative semesters:

1. Change of a teacher resulted in increased interest of students for lectures and seminars
2. Students were more active and they got involved in activities of innovative teachers
3. Many of the presented topics and activities were new for students, for example digital competencies of a teacher, creation of tasks for leading of cognitive process of students etc.
4. Some of the activities were difficult for students and they asked for another workshops
5. Students did not have experience with innovative teachers and they appreciated their work
6. Many students who were not decided whether they will go to teach after finishing their degree were positively motivated by innovative teachers
7. Students appreciated the ability to gain materials form innovative teachers

One of the main criterion of attractiveness of being a teacher is an existence of career system. Slovakia has a system of professional development of pedagogical and vocational employees in the career system (Law n.390/2011 Z. z., which is changed and supplemented by Law n.317/2009 Z. z. about pedagogical and vocational employees). The main problem of current system is absence of professional standards which are used in other countries. Experiences with education – professional development of pedagogical and vocational employees are rather negative than positive. Educative courses can be organized by universities and by methodological and pedagogical centers, educational institutions (state or private) etc., but the quality of these courses is questionable. In 2013 teachers could attend dozens of accredited courses (refresher, specialized, innovative, etc.) but the predominant are courses focused on coping the work with digital technologies.

Terms as modernization of school and modernization of education mean for a public and teachers equipping schools with modern digital technologies and using them in teaching, but integration of digital technologies into education should be connected also with new methods and forms of work. However, this is sometimes forgotten. We mentioned national projects as “Modernization of education system at elementary schools” (MVP ZŠ) and “Modernization of education system at high schools” (MVP SŠ) in the previous report. Aim of those projects is to change form of teaching at schools, which will lead to modernization by connecting modern technologies with teaching and to prepare teachers for active realization of the school reform by adapting educational system to needs of the society. Projects are focused on innovation and modernization of the content of education and methods in teaching, but mainly on the preparation of teachers with new competences for a work in the Modern school of 21. century (less memorizing for students, more interesting lessons, better possibilities for self-realization for teachers and the new system of the career development). Target groups of those projects were teachers of elementary schools and high schools from Slovak Republic, who teach at least one of these subjects: Math, Physics, Chemistry, Biology, Slovak Language, History, Geography, Music and Art.

Teachers who successfully completed the educational project graduated from the specialized education (Law 317/2009 about pedagogical and vocational employees) and they are given 35 credits. The actual amount of teachers of subjects of Biology, Chemistry and Geography who successfully graduated connected with the advocacy of the final work is 1163 which is 74,07% from the total amount. National projects MVP ZŠ and MVP SŠ belong to the biggest educational projects which have been realized in the last 5 years in Slovakia. They have affected thousands of teachers. Department of Education plans to ask graduates of those projects in the subject of Chemistry for the feedback – how they perceive the training after some time, what they use in the lessons from the trainings, which technologies they use.

Faculty of Natural Sciences UKF in Nitra prepared educational program for teachers of chemistry named Chemistry in Practice within the project PRIMAS which aims to support integration of revelatory teaching (IBL) into teaching math and scientific subjects. There were 24 teachers present at the first training. The range of the education was 60 lessons (<http://www.primas.ukf.sk/index.html>). The education consisted of lectures, seminars, practical exercises in the topics of chemistry of plastic and chemistry of daily life (cosmetic chemistry, chemistry in food, chemistry in cleaning).

3. Main barriers in preparation of future teachers of chemistry and practice teachers



Presence of good teachers (connected with the preparation of future teachers) at schools is dependent on two factors:

- Interest for a job in education and good selection of applicants and their preparation before starting working
- Opportunities for further improvement while teaching (continual education).

From those factors result need of changes in the system, providing of a good selection and preparation for the work in education.

For this it is needed to:

- increase attractivity of the job of teacher (from the financial point of view)
- provide a good selection of applicants and orientate on the best graduates of high schools
- work out professional standards for beginning teachers and improve the quality of preparation for teaching (so that graduates will be able to provide educative process in the harmony with ŠVP of the certain kind of school and education. It means that preparation of future teacher for elementary school has to have different pedagogical – psychological preparation than a future teacher for high schools)
- provide enough practical teaching in preparation of future teachers
- provide high difficulty for studying teaching
- after graduating and pre-gradual preparation providing another professional development and growth

For improving of professional growth it is needed to toughen the process of accreditation of programs of continual education and to provide feedback from participants of education, toughen the requirements for professional grants and provide the control of quality and progress of programs of continual education. From TALIS 2008 study results that Slovakia belongs to countries with the highest amount of highly qualified teachers who do not continue in another continual education.

As the main problem in preparation of future teachers are considered: missing unified way of preparation, the big amount of faculties preparing future teachers, dividing of the study at BSc. and Mgr. degree (the implementation of BSc graduates is not provided), little amount of practical education (pedagogical practice), small connection between the practice and the theory, disinterest for studying teaching, not enough applicants.

The main problem in preparation and education of teachers is implementing of credit system because teachers want to get credits and they are not interested in professional growth and improvement of the educative process and insufficient offer of the further education. After successful graduation from the courses teachers get credits which entitle them to qualification progress with higher financial evaluation or entitle them to do attestations, etc. Teachers can be educated in many projects (financed by EU) in many educational institutions, methodological centers and various organizations which offer educational accredited courses. The question is whether the courses are good, whether the teacher learns something he can use in his pedagogical practice. Schools have bought expensive digital technologies – computers, interactive boards, visualizers, voting machines, measuring machines for experimental activities and many times a teacher does not know how to work with them and how to use them in educational process. On the basis of this, teachers choose courses which are focused only at technical side but not at didactic application into educational process. Interactive board is many times used as expensive screen on which videos and PowerPoint presentations are projected. Teachers do not know how to work with the program and how to create educational materials in them. It is the same with the measuring machines which are great for experimental activity of students but are also very expensive.

If we want to have modern and flexible system of education which will guarantee quality and efficiency then it is needed to rethink previous strategies of changes. It is needed to establish professional standards for teachers. Major impact on results of students has quality of education and learning which is provided by a teacher. If we want to have good teachers it is needed to start in pre gradual preparation of pedagogical employees and continue in good continual education.

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