

CHEMISTRY TEACHERS' TRAINING IN POLAND

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ABSTRACT

The paper is going to present the Polish national scene on Chemistry Teachers' Training according to the Chemistry is All Around Network project requirements. The paper will briefly introduce Polish national trends in teaching science subjects, chemistry in particular. It will also consolidate the information about educational system in Poland; with reference to chemistry teaching and the career path development of a teacher in Poland. Space will be devoted to presenting the main obstacles to teachers' development process. Comments will be made about the most innovative pre-service and in-service teacher trainings and workshops available on the Polish educational scene supporting teachers in the classroom and motivating learners at different levels of education to explore chemistry deeper and further on their own. Some references will be made to the teachers and experts' workshop organized at WSIU premises on the above topic.

Introduction to National Situation on Teacher Training

For a long time there has been observed graduated decrease of teacher profession prestige in the Polish society. This fact is due to many reasons, of which the most important is relatively low salary and the common negative opinions about the condition of education. As a result, smaller numbers of students, deciding to acquire qualifications for doing the teachers's job, undertake the opportunity of the profession. They are rather motivated by security in case of not finding more desirable job after being graduates. The educational system reform which started in 1999 made it necessary to undertake some actions aiming at the improvement of the conditions of the teachers' education. The reform assumed quite different attitude towards the tasks of school and thus the methods of teaching. First of all reevaluation of learning outcomes and teaching objectives took place evidenced in divergence from teaching based on memorizing often useless information by pupils and paying more attention to understanding knowledge being acquired and ability to use it. It is assumed that school should train the skills of universal character as well as form and develop attitudes important as regards further development of pupil and his future life in the society. That requires from teachers application of teaching methods developing cognitive activity and engagement of pupils. At the same time the teachers should analyse the course and effects of his work with pupils and improve his teaching accomplishments. Moreover, the possibility created by the reform of a few or even several handbooks for a given subject functioning at the same time provides a serious task of choosing an optimal curriculum and handbook. Starting junior secondary schools as a new type schools caused that is necessary to employ teachers prepared to teach two or even more subjects. The decrease in the demography can effect also the way of teacher education in the nearest years. The smaller demand for teachers will cause higher requirements for teachers' qualifications without fear of teaching staff shortage. A favourable effect on changes in teacher education results from international contacts allowing the exchange of experiences. Some attempts have already been made in this course as evidenced by the decree concerning the teacher education standards which is prepared by the National Ministry of Education. The decree did not change in main issues from the currently valid regulations but makes them more detailed. It suggested the increase of the number of hours for teacher educating subjects including 60 hours of so called complementary courses which, besides obligatory lessons in voice production contain humanistic subjects like ethics, language culture, history and region culture etc. The novelty is the requirement for the prospective teacher at least one foreign language on the advanced level. The knowledge and skill concerning psychology, pedagogy and subject methodology are also outlined. The activities taken by the National Accreditation Commission will surely effect the changes in teacher education. It is authorised to evaluate education quality and to control conditions of higher education in all Polish Universities – public, private, academic and technical. Its activity includes also evaluation of teacher education. It began the



works in 2002, so far focusing mainly on analysis of functioning of some subjects of studies. At the moment it deals with curricula and quality of the courses preparing for the teacher's job. Undoubtedly, this will promote better preparation of prospective teachers for doing their job. Let us now analyse the situation of formalised science in Polish schools. After the educational reform the science subjects: biology, chemistry, physics and astronomy as well as geography are taught on the two levels only: Junior Secondary School (3 years, aged 3-16) on the average 3 hours of each subject distributed in the period of three years; e.g. 2 hours of biology weakly in the first form and 1 hour in the second form. Senior Secondary School (3 years, aged 17-19) on the average 3 hours of each subject during the first two years, obligatory for all pupils. During third year maximum 8 hours optional for one or two of these subjects in the classes of suitable range of interests e.g. biology and chemistry, environmental classes etc., The training of teachers in higher education institutions is mostly provided within the fields of study which prepare specialists for various professions (e.g. studies in the field of chemistry prepare specialists for work in industrial enterprises, research institutes and laboratories as well as teachers of chemistry). Syllabuses and curricula in higher education institutions are determined by their autonomous authorities. Practically all institutions of higher education introduced the ETCS system to make international exchange of students easier. Within a field of study students may either choose a teacher's specialisation and acquire teacher's qualifications as part of their studies or complete studies without a specialisation and acquire teacher's qualifications upon completion of post-graduate studies or qualification courses. The Minister of National Education determines qualifications required of teachers and the minimum number of hours assigned for pedagogical preparation. According to the regulations issued by the Minister, pedagogical preparation must comprise hours in pedagogy, psychology and field-specific teaching (i.e. the methodology of teaching of a field-specific subject) and teacher practical placement in school, which corresponds to 10 weeks placement in school. Getting credits of the professional course during the 5-year studies [M.Sc.] qualifies for teaching in the Junior and Senior Secondary Schools. However, finishing the 3-year professional teacher studies [B.Sc.] qualifies for teaching only in the primary School. Higher education institutions train mostly teachers of one specialisation, though recently they have also started to introduce studies covering two specialisations (two subject teachers), mainly combining related specialisations (e.g. chemistry with biology or physics, biology with environmental protection, etc.). Teachers may also be prepared to teach a second subject in the post-graduate studies lasting 2 to 4 semesters.

1. Initial Teacher Training

The chemistry teacher must be able to bring his enthusiasm for chemistry into his classroom in an organized manner so he can present lessons to his students. The organizational skills are also necessary to perform routine teacher assignments, such as recording attendance and grades. He must also have knowledge of the laboratory equipment and its safe use so he can help his students set up experiments in a safe manner. Communication skills are necessary as the teacher works with students to teach them the advanced math and science concepts involved in chemistry. The teacher must also communicate effectively with parents and with his peers as he works on professional development activities, such as curriculum development.

The question arises: How to get qualifications to teach chemistry in junior secondary school and senior secondary school? Let us analyse the situation on the case of Jagiellonian University in Cracow. The main task of the Department of Chemistry Teaching is to prepare students to become teachers. Eligibility for teaching chemistry applies to all levels of education. Every year, many students acquire the right to teach chemistry in schools. All the completed courses prepare them to conduct training, speeches and presentations, evaluating and managing people in places other than school work. Through better professional preparation the teaching profession, though difficult, is able to give a lot of satisfaction.

In order to get the right qualifications to work as a Chemistry teacher in junior secondary school and senior secondary school, chemistry students must submit a master's degree and complete several courses of chemistry in the College of Education at the Jagiellonian University and the Department of Chemistry Teaching. All the students are strongly advised to start their professional training as early as possible (e.g., in the third year of undergraduate studies), in order to avoid too many classes coinciding at one time. The obligatory courses: at The College of Education Studies: include general pedagogical and psychological preparation - two courses of 45 hours each, and psychological and pedagogical training for teaching in secondary education - two courses of 30 hours each. As far as the Department of Chemistry teaching, Faculty



of Chemistry is concerned students must complete the following trainings and courses: Basic Teaching - Seminar 30 hours. (winter semester, first year, second degree); chemistry teacher - lecture 30 hours (summer semester, first year, second degree); Teaching Chemistry A - exercise 45 hours., including 15 hours. practice at school (spring semester, first year, second degree); Teaching Chemistry B - exercise 45 hours, including 15 hours practice at school (winter semester, second year, second degree); specialist course - classes 15 hours, one of the teaching of courses to choose from (spring semester, or second year, second degree); Practice in school - 120 hours. Much attention is paid to the problems connected with the changing situation in the educational system. This includes, for example national exams which started already last year, multidisciplinary educational paths, new curricula and handbooks as well as teaching aids etc. If possible other problems concerning everyday work of teachers, like requirements for promotion are discussed during classes. During classes each occasion is used for improvement of students' skills, particularly when they are of significant importance in teacher's work and useful during training courses. Simulation of the fragments of the lesson prepared earlier by students is essential. They are recorded by the television camera, then replayed and analyzed together. During practice at school, on one hand the students can test their skills acquired during the classes at the university and on the other hand they train new skills which they will be able to develop and improve during further classes at the university. The experiences from the practice should make them aware the importance of systematised knowledge in didactics of chemistry field which they get to know during these classes. The choice of school for the practice is not accidental. The first practice takes place in the senior secondary school. However, the substantial knowledge required for conducting lessons on this level is greater than in the junior secondary school but easier as for as teaching methods are concerned. The second practice takes place in the junior secondary school. The level of pupils' knowledge in this stage is more differentiated and in the earlier intellectual development than in the senior secondary school. Conducting lessons in the junior secondary school requires more skills and experience, which is confirmed also by students. Another factor is more serious educational problems with pupils students encounter during the practice in the junior secondary school.

The aim of practice at senior secondary school is to get preliminary knowledge about teachers' work and to practise the skills acquired in the first period of classes at the University. At the same time it should be motivating for students for further part of the course in the didactic of chemistry. Then coming back to the University, the students participate in classes to acquire more advanced professional skills. Further possibilities of improving skills connected with planning, preparing and conducting lessons acquired during the integrated laboratory – seminar classes in didactics of chemistry are provided by the practice in the junior secondary school. Testing students' skills takes place in the final period of the practice when students got used to school, got to know pupils and working conditions. Then the lessons conducted by them are attended and evaluated by the teacher and the supervisor of the school practice courses who is the university worker. The evaluation is made using the especially prepared lesson analysis sheet. Using this sheet a few skills are evaluated, among others: the preparation of scenario of the lesson, choice of a suitable teaching method, using teaching aids, activating pupils, emphasising importance of chemical knowledge etc. Positive evaluation of the attended lesson is necessary, though not the only condition of creding the school practice. The students' skills tested during the final subject – didactics of chemistry courses are also part of an exam in chemistry education. After finishing the school practices the students still participate in the seminar which takes place in semester IX. Its aim is to sum up and consolidate the knowledge acquired during two semesters of didactic of chemistry classes and practices at school. It consists in successive activities connected with preparation for realisation of the chosen section in the curriculum of chemistry teaching in the junior or senior secondary school and then in their analysis. This creates the occasion for students to make aware that teacher's job is not copying the same procedures all the time. They also see that the ability of critical analysis of curricula, handbooks, choice of teaching aids as well as verification of effects of one's own work and improvement of professional skills are of significant importance. In many cases students must refer to their chemical knowledge. Then it proves that in some cases they have difficulties with presenting some chemical problems in a simple way comprehensible for pupils and they also become aware of the gaps they possess in their chemical knowledge. This is the starting point for another thought about significance of good command of subject knowledge, which they must deliver to pupils. The exam in chemistry education which ends this course of classes is to perform an important function as passing it is confirmation of qualifications for becoming a chemistry teacher. It consists of a few elements whose aim is to check: the extent of chemical knowledge acquisition in the



scope of junior and senior secondary schools, knowledge in chemistry education, abilities for planning teaching and educational activities, abilities for conducting the lesson.

2. In-service Teacher Training

After starting teacher's job it is possible to attain the following categories of promotion: trainee teacher; contracted teacher; nominated teacher; chartered teacher. Promotion to higher category will require the upgrading of qualifications and pay rises will be tied to the teaching post category and teaching performance. The teacher may be promoted to a given category if he/she: holds required qualifications; has completed a practical placement which ended with a favourable assessment of his/her achievement during the placement (the placement is based on the individual skill development programme); has been accepted by the selection committee or, in the case of the contraction teacher, has passed an examination conducted by an examination board. One of the conditions for teacher's promotion are postgraduate studies or other forms (courses) of professional improvement. The postgraduate studies usually organized by higher education institutions provide qualifications for teaching other related subjects. Another type of such studies enables improvement of professional qualifications in the range of the taught subject.

Currently in-service teachers have plenty of opportunities of professional development. They can select from many high quality offers among which is the one of the Centre for Education Development (CED). It was established on 1 January 2010, as the result of merger of National In-Service Teacher Training Centre and Methodological Centre of Psychological-Pedagogical Counselling. CED is a national teacher training institution. The Centre objectives include actions for quality assurance in education, particularly through supporting schools and educational institutions in carrying out their statutory tasks and support of changes in the system of education in the field of teachers' professional development. The new Polish science curriculum was launched in the 2008 and currently implemented in upper secondary schools. The new general objectives of education, and students' key competences that should be developed during science classes were defined in that document. Presented competences are in line with competences that might be developed by *Inquiry Based Science Education* (IBSE). IBSE is currently a popular instructional method in many countries and it is being strongly promoted by European Union. In the article the role of IBSE in the new Polish science curriculum is described and related to the method of 'Independent Investigation to Acquire Knowledge' that was formerly known in the national pedagogy.

Many universities of polytechnics organize Post-Diploma Trainings for teachers. Among others the institute of Didactics of Chemistry in Siedlce offers an interesting course for Chemistry and Maths teachers. The aim of programme is to give the person who completed the master's degree in the fields of chemistry permission for teaching chemistry in junior secondary or upper secondary school and mathematics in primary school, junior secondary school and upper secondary school. The course is also addressed at students of the second cycle courses related to chemistry or mathematics. In their case, they will be conferred the right to teach chemistry or mathematics, in schools mentioned above, on their graduation from the second degree programme (Master's degree). Within the programme of 340 hours students will gain theoretical and practical knowledge of psychological - pedagogical preparation for teaching chemistry or mathematics. Plan of Study activities and programs are tailored to the Ordinance of the Minister of Science and Higher Education of 17.01.2012 in the matter of educational standards - to prepare for the teaching profession. Students are also required to serve 155 hours practice. Another example of good practice in terms of chemistry teacher development is WCIES. It is a self-government teacher development facility – an institution providing knowledge and education, whose tasks perfectly illustrate the motto "Warsaw – the City of Education". The main objectives of the Centre include supporting the Warsaw educational environment and improving the quality of work of schools and educational facilities in the City of Warsaw through different supporting forms for teachers, include biology and chemistry teachers. The Centre has certain experience in advocating the application of the IBSE method at the 4th educational stage, primarily in the area of professional continuing education for biology teachers interested in new educational solutions. Warsaw Centre for Socio-Educational Innovations and Training has been providing a comprehensive set of activities to support professional development for science teachers for several years. Since 2009, the centre has attracted more than 2500 teachers to workshops, lectures, conferences, seminars and model lessons. Topics for lessons have included: news from the science world, new teaching methods, biological and chemical experiments and observations, and more. The training programme, based on the new



Polish core curriculum in biology and chemistry, consists of lectures and hands-on learning activities provided by expert scientists from Warsaw University and Nikolaus Copernicus University in Toruń.

3. Assessment of the National Training of Science Teachers

Drawbacks of Teacher Training in Poland

Analysing the situation in Poland one can draw some conclusions. Polish student of Chemistry at University or Polytechnic is better prepared for teaching in theory than practice. He/ she has access to equipment and chemical experiments when at University and then lacks the opportunity to experiment when starts proper teaching at schools, which do not even have properly equipped chemistry laboratories. Another downside is the educational reform in Poland itself which according to some experts interfered with the core curriculum development - for the last few years it got changed few times which results in disorientation and lack of cohesion of ministerial requirements and the factual learning outcomes and teaching objectives. What is more, according to ministerial regulations a Chemistry teacher is supposed to develop professionally (each teacher in Poland follows a career development process – 4 stages) but during the process his/ her chemical knowledge is not much verified. Their pedagogical skills are verified however chemistry experimentation and core chemistry issues lack monitoring. There is an offer at few institutions of some professional development, refresher training available for in-service teachers but courses, workshop, conference and training organized by them are not mandatory, and usually if of higher quality, also quite expensive. On the other hand, such courses help teachers enrich their classrooms with cutting edge developments in the exciting field of nanotechnology, learn new pedagogical approaches to teaching science, provide teachers with the opportunity to refresh their understanding of core science concepts and to connect with their peers. One semester long course meets weekly and the 3 hour class is broken into 3 segments: a/ Teachers are immersed in chemical research via laboratory tours, demonstrations, hands on experiments, or lectures from graduate students. b/ Teachers discuss how to most effectively bring this research into the classroom, develop lesson plans and reflect on how they have used the course in their teaching. c/ Teachers are equipped with chemistry fundamentals and provides with alternative teaching techniques to improve student learning by provoking thought about experimental observations. The goals of this development program are to expose teachers to the research environment, to reinforce each teacher's sense of science as a process, to deepen each teacher's understanding of the achievements and potential of chemistry, and to apply lessons learned from the content class to a research setting a scientific discovery. As seen above the Polish chemistry teacher has to cater for his/ her professional development on the individual basis which may result in the lack of motivation and loss of quality of teaching. Last, but not least, the Polish Chemistry teacher lacks good English language skills which is very limiting and can slow down self-teaching and restrict use of solutions applied by foreign chemistry market.

4 Conclusions

Lack of compact and sufficiently precise conception for educating prospective teachers as well as requirements for teacher educating institutions has an unfavourable effect on the standard and results of educating teachers and making great differences in preparation for this profession from one to other university. The Graduates of the universities, where mainly focus on formal execution of very general regulations presented above are taken under consideration, can obtain credits from suitable subjects but this does not mean acquiring basic skills necessary for proper accomplishment of the teacher profession. Changing life conditions as well as requirements connected with our membership in the European Union call for the need of changes in teachers' attitude to pupils' science education which plays a significant role in their preparation for life in ever changing science and social reality. This requires suitable education of science teachers and continual improvement of professional skills of active teachers.

Pupils science education starts in primary school where, along with the education system reform introduced a few years ago, a new subject – science appeared which required proper training of teachers. Organization of suitable courses of training teachers of quite a new subject was for many reasons a difficult task. The work had to be done from the very background as there was no practical experience in preparation of elementary science teachers as well as no curricula and handbooks for this subject



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