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**On Some Experience with an  
Innovation of Initial Mathematics  
Teacher Training and its  
Evaluation**

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## An Introduction to ATINER's Conference Paper Series

ATINER started to publish this conference papers series in 2012. It includes only the papers submitted for publication after they were presented at one of the conferences organized by our Institute every year. The papers published in the series have not been refereed and are published as they were submitted by the author. The series serves two purposes. First, we want to disseminate the information as fast as possible. Second, by doing so, the authors can receive comments useful to revise their papers before they are considered for publication in one of ATINER's books, following our standard procedures of a blind review.

Dr. Gregory T. Papanikos  
President  
Athens Institute for Education and Research

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## **On Some Experience with an Innovation of Initial Mathematics Teacher Training and its Evaluation**

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### **Abstract**

The quality of mathematical education is a very contemporary didactic topic at present. Improving the quality of education is unthinkable without a quality mathematics teacher training at universities and other educational institutions. The contribution deals with some innovation possibilities of contents and organization of the study programme for future mathematics teachers realized within ESF project "Professional training of teachers of sciences for careers in a competitive environment" at Faculty of Science of Palacky University in Olomouc, Czech Republic. The project focuses on improving the training of teachers of all science branches in connection with the growing needs of the current competitive labour market. One of the main aims of the project leading to this improvement is the creation of innovated curricula and special textbooks for these programmes. Another objective of the project is to create a system of university schools, mainly for an implementation of a newly conceived student teaching practice. A complete evaluation was carried out to strengthen the feedback from pilot education of new and innovated subjects as well as the new teaching practice. The aim of the evaluation was to determine the difference between expectations and real benefits of the subjects and the practice. The evaluation results are very useful as a feedback for a subsequent modification of the study programs. Some particular innovative modifications of study program for mathematics teachers are described in the paper.

**Keywords:** Study programme, initial teacher training, mathematics, evaluation.

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## **Introduction**

An evaluation as a process or as a result of an objective assessment of the value, quality and efficiency of target programs, results, resources, conditions, contexts .... (Švec, 2002, p. 208) should serve as a feedback for realization of a project. The purpose of a project evaluation is to evaluate whether and to what extent the project objectives are fulfilled. The project evaluation is also a means of checking the correct and successful implementation of the project. According to Westat (2002), the current view of evaluation stresses the inherent interrelationships between evaluation and programme implementation. Evaluation is not separate from, or added to, a project, but is rather part of it from the beginning. Planning, evaluation, and implementation are all parts of a whole, and they work best when they work together.

## **Characterization of the Project**

The project aims to improve the training of teachers of science subjects in line with the growing needs of the current competitive labour market. One of the main aims of the project leading to this improvement is the creation of innovated curricula for teacher training in mathematics, physics, chemistry, biology and geography at the Faculty of Science at Palacky University in Olomouc, including a common base and teaching practice. Within this key activity new syllabi of some selected subjects were created and study textbooks were specifically treated for teaching these subjects. Pilot teaching of the innovated subjects is aimed at testing the innovated items on the target group of students of teacher training of science branches. A feedback based on the evaluation of the pilot teaching is used to modify the content of the final innovated subjects before their inclusion in regular study programme. Another objective of the project is the creation and development of university schools system in the region of Palacky University, in particular for the purpose of the implementation of the newly conceived student teaching practice. University schools will also be used to realize education research of students and university teachers and systematic work with potential applicants to study at the Faculty of Science at Palacky University. The project target group consists primarily of students studying teacher training programme of natural sciences at the Faculty of Science, as well as secondary school students (potential applicants for the study at the Faculty of Science) and university teachers involved in training of the future teachers. The support for secondary school students is implemented within the project mainly by popularizing events, competitions, educational seminars, etc. Educational events thematically focused on the needs of teaching practice are organized for the target group of university teachers and students.

## **Evaluation of Innovated Teaching and Teaching Practice**

The starting point for the evaluation was whether the teaching of new subjects which were integrated into study programmes would be helpful for students. Another question was whether the newly conceived concept of teaching practice would be more beneficial for students and also for their experienced supervising teachers than the old concept. The form

of a questionnaire was chosen as a method of evaluation. Four research tools – questionnaires - were developed. Two were designed for evaluation of teaching and two for the evaluation of the teaching practice. The evaluation of the whole project is divided into the evaluation of the teaching of new subjects included in the study programme and the evaluation of the teaching practice in a new concept. The first part of evaluation runs twice each semester, always at the beginning of the semester and at the end of the semester when those subjects are taught. The evaluation of the teaching practice is different. The teaching practice is also assessed twice; the first time from the perspective of a practicing student who gains teaching experience at school and the second time from the perspective of an experienced teacher with whom the student held the practice. These two forms of evaluation are always carried out at the end of the practice. Using the questionnaires during the evaluation of teaching of new subjects there were compared the expectations of students at the beginning of the course with the fulfilment of the expectations at the end, i.e. with their evaluation of teaching the subject throughout the semester. For this reason, the evaluation took place immediately at the beginning of teaching, i.e. in the first lesson of the subject. As a research tool, the questionnaire was used which investigated whether students expectations of this course were to acquire new knowledge, skills in practical or theoretical platform, whether they expected well-prepared teachers, and whether a motivation for choosing the subject was their interest. The evaluation questionnaire that students filled out at the end of teaching the subject, again carried the questions relating to the acquisition of new knowledge, and practical and theoretical skills. Other questions related to the quality of the professional preparedness of the teachers, the subject content - whether the students were interested in the subject, whether the form of implementation suited them, whether the issue was new and rewarding for them, whether they had enough quality literature and whether they would chose the subject again. Finally, the students rated the subject with a mark from 1 to 5, where 1 meant the best rating and 5 was the worst one. All questions except the last one were multiple-choice questions, the possible answers being: yes, partly, no, no answer. The questions were deliberately formulated with closed response options because of easier statistical processing. There were two questionnaires to assess the teaching practice. The first one investigated the perspective of a student who had just finished his/her teaching practice at school. Here the student was asked how he or she was prepared from university in terms of knowledge and skills in the subjects of his or her qualification. Further interest was to find out whether a student was informed about educational programmes used at school. Whether he or she was able to formulate the goals of teaching, to structure a lesson, whether he or she managed to motivate pupils properly, to have contact with them, to answer their questions, to evaluate their performance, to manage educational problems. Whether he or she managed to make appropriate use of information technology, whether he or she could prepare a written examination and conduct an oral examination, whether his or her speech was comprehensible for the students. In one of the items the student was asked whether the practice was used to collect data for educational research. The last item of the questionnaire provided the students with space to comment all activities which exceeded their duties. In the second questionnaire, filled out by an experienced teacher with whom the student held the practice, were items of similar content. The teacher used them to evaluate the student practitioner. All items except the last one offered options from 1 to 4, where 1 meant excellent and 4 unsatisfactory evaluation ratings. The research group for evaluation of the teaching was formed by all students who chose the subjects newly integrated into the study programme in the semester. Almost all the questionnaires in all new subjects were returned. It was because the teacher distributed the evaluation questionnaires at the beginning and at the end of the teaching practice

personally and the students returned them to the teacher personally as well. The research group for evaluation of teaching practice in the new concept was formed by all students who realized their teaching practice in a given semester. Before starting the practice they received the evaluation questionnaires in both versions (for themselves and their teachers) from their methodologist of qualification subjects which returned to their methodologist after the practice. This ensured an almost total return. The data obtained from the questionnaires were processed into tables and graphs with absolute and relative frequencies. A comparison of responses was made at the beginning and the end of lessons, if the subjects were in a sufficient number of respondents. Thus the difference between expectations and evaluations of the subject was assessed. Similarly, the items of student and teacher evaluation of teaching practice were compared. To observe anonymity it was necessary to use the two-sample (unpaired) method, and a nonparametric method according to the type of answers. Using the Mann-Whitney test for the significance level of 0.05, statistically significant differences were investigated. The comparison could not be made in the cases where a sufficient number of respondents was not available. The evaluation was done using the system SPSS, version 12.0. Two evaluations of teaching and teaching practice were performed in the current phase of the project. In the first evaluation, teaching of the following new subjects was evaluated: Introduction to Study of Mathematics, Current Issues of Teaching Mathematics, Fundamentals of Educational Research, Local Region in Teaching Geography, Current Issues of Teaching Geography and Current Issues of Teaching Physics. When comparing the initial state and the final state of the subjects, no statistically significant difference was found. It can be established that new subjects met the needs of students. The practices of subjects Biology, Mathematics, Chemistry, Physics and Geography were evaluated within the first evaluation of the teaching practice. Connected answers of student and teacher responses were compared if a sufficient number of respondents was available. The chi-square test or the Fisher's test were used for the evaluation. If the requirements for these tests there were not fulfilled, the two-sample U-test was used. Everything was done using the system SPSS, version 12.0. A statistically significant difference was detected only for question number 1 in teaching Biology, where the students stated how they were prepared at university in terms of knowledge and skills for teaching the subject. The students were very critical and in 55% claimed that they did not have sufficient knowledge and skills in the subject of their qualification compared to 96% of teachers who were convinced that students had sufficient knowledge and skills to teach at secondary school. Within the teaching practice of chemistry, a statistically significant difference was determined between the student and teacher response to the question regarding making contacts with pupils, communication with them and the use of the correct terminology. The students were convinced 100% that they spoke standard language, used the correct terminology and spoke clearly. However, the teachers argued that this was less than 60%. Within the teaching practice of geography, statistically significant differences were found in questions 1, 2, 3, 4, 5, 8 and 10. The views of the students and the teachers diverged in their responses about whether the students had enough knowledge and skills for teaching their specialisation, about knowledge of educational programmes, about the skills to formulate an objective of teaching, to structure curriculum properly, about the ability to motivate pupils, the use of suitable demonstrations, teaching aids, information technology and about the ability to mark the students according to their performance. Teaching of the following subjects was assessed within the second evaluation: Introduction to Study of Mathematics, Current Issues of Teaching Biology, Revision of Secondary School Geography, Revision of Secondary School Physics, Revision of Secondary School Chemistry and Fundamentals of Educational Research. When comparing the initial state and the final state of the subjects, no statistically



significant difference was found. The second teaching practice regarded the following subjects: Biology, Mathematics, Chemistry, Physics and Geography. Again, connected answers of student and teacher responses were compared if a sufficient number of respondents was available. No statistically significant difference was found in any item of any subject.

## **Conclusion**

A general conclusion can be achieved from the evaluation: the implementation of new subjects was successful and met the expectations of the students. The new approach to the teaching practice has resulted in a stronger feedback and the subsequent creation of conditions for improvement of the practice. A scientific conference on the issue of education of science branches teachers will be organized at the end of the project. Further experience with innovative teaching and results of its evaluation should be presented.

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