

DISTANCE INSTRUCTING OF IN-SERVICE TEACHERS IN COMPUTER-BASED MEASUREMENTS

Karla Holá, Václav Koubek, Miroslav Šedivý, Soňa Bendíková, Vincent Cigánik, Marián Danišovič, *Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia*

Introduction

Innovation of skills and knowledge is an important issue for anyone's development and life in general. If it concerns teachers, it is of a crucial necessity to stay up-to-date and topical, since teachers do have a great impact on knowledge and skills of other people. Physics as a vital natural science has been undergoing a permanent evolution. Similarly also tasks and methods of didactics of physics have been changing in the modern society. However, the most dynamic development, which struck ordinary people, has been registered in the field of information technologies. Consequently this extraordinary development has remarkably influenced also teaching methods and opened new learning possibilities.

Institutional introduction

It was the very work with information technologies, which became a new item in teacher training courses of pre-graduate students at the Department of Physics Education in recent years as a result of the accomplishment of the international project TEMPUS AC_JEP 13101-98 „Innovation of teacher training in physics and maths“ at which the Department took part [1]. At present, the usage of multimedia tools like dynamical models, video clips, computer-aided laboratories and Internet sources has already been well established in pre-graduate teacher training. Hence, now we have approached the phase of dissemination of these tools among in-service teachers in order to provide them with methods and materials, enabling them to motivate their pupils and increase students' activity.

So far the computer-assisted education has been only rarely used in primary and secondary education especially out of two reasons. First because of bad equipment and accessibility of computers for the purposes of physics education, second for the low computer literacy of school-teachers. Out of the latter reason the necessity of further education of teachers has arisen. Considering the workload of teachers and the opportunity of decentralization of education a distance communication could be an appropriate means of instruction. For the research in this field the Department received a support of “Open Society Foundation” working on the project of “Distance education of physics' teachers – New techniques in physics' education at primary and

secondary schools". Let us mention also other related activities of the Department. They have been devoted to the topics of "Microcomputer Based Laboratory Applied in Physics Education and Teacher Training" (TEMPUS JEP 0119/91/93, in cooperation with the University of Amsterdam) and "Innovation of competences of a physics' teacher" [2]. These projects are of a high importance since a new curriculum for subjects of general education is going to be prepared in Slovakia. After approving the educational standard as well as the recommended teaching methods, distance learning is possibly going to be a tool for spreading these changes and environment for retraining the teachers for the needs of the new standard.

Implementation

At present at the Department we have just finished the first part of distance instructing of a small group of secondary-school teachers from various regions of Slovakia. The distance learning has been highly voluntary and individual. It has been mostly focused on computer-based measurements, dynamical modelling of physical phenomena and collecting data out of real-life video clips using hardware and software of a Dutch product - Coach. The required interface, a few selected sensors, accessories and the software were lent to the participants for the duration of the course.

Let us briefly introduce the chosen device. "Coach 5 is a versatile learning and authoring environment for Science, Technology and Mathematics" [3]. It contains tools for on-line and off-line measurements and control, data video - measurements on science video clips, creating dynamical graphical and textual models and their monitoring and simulation. An important feature of Coach is the opportunity of advanced data processing like graph prediction, scan, function fit, slope, derivative, area, integral, etc.

Our objective was to acquaint learners with as many of these tools of Coach as possible, practise their usage in several activities and make the learners self-reliant users and independent authors of the activities all within 12 weeks of the course. The activities were designed by the instructors in such a way to let the participants do all the settings themselves according to the instructions given directly in the activities. In addition also supporting materials were published on a web site to be freely accessible at any time, in order to help those interested. Furthermore, studying materials were distributed also by CDs - "Chapters on Didactics of Physics" and "Experiments and Models in computer-based laboratory" produced by the members of the Department. As for the course of learning we took advantage of both means of communication, personal and distant. The initial meeting of the participants with the training centre was inevitably a presence one organised for the purpose of lending the necessary Coach hardware but also devoted to basic instruction in Coach usage and fundamentals of means of electronic communication. The

rest of training was delivered over distance. The communication was performed via e-mails, chat, audio and video transmission by NetMeeting. An important tool within NetMeeting there appeared to be desktop sharing of a distant computer. It assisted with solving many practical problems. The study was being carried out both in synchronous and asynchronous way. The curriculum of the course was divided into 10 separate lessons - one activity per week. As mentioned above, the activities were produced in order deal with various functions of Coach. We have not used any special e-learning system so far. The activities were being released by means of the departmental electronic news board, in which a special section was devoted to this purpose and the members of the group could download the activities into their Coach environment. On the other hand the news board enabled them to add a contribution, whether addressed to fellow learners or instructors. However, most of the participants did not take advantage of this chance. Let us mention also another remarkable point. The notice board contained a forum's planning calendar of either personal or public events. Participants thus could sign up for the electronic meeting, booking certain date and time publicly. As concerns assignments and requirements laid on distant learners, those not familiar with any of computer-based environments before starting the course were strongly recommended to send us back the executed activities to check them out, or possibly to correct them. Of course they had opportunity to discuss any problem, which might have occurred, by NetMeeting afore. In this way we tried to differentiate the levels of participants' skills in handling Coach. All the participants were required to work up at least one measurement, one modelling and one video measurement activity on their own and to present them at a final presence meeting. Besides that the final meeting was mainly devoted to discussion of their own experiences of Coach usage at schools.

Results

After taking active part in the distant course all the participants have been able to work in computer-assisted laboratory based on Coach software and hardware. We can consider the first part of their distance learning successful also according to indicators of the achievement of goals, which were defined before starting the whole project. Let us quote some of the accomplished ones. The students are obviously able to communicate by e-mail as well as by NetMeeting with the training centre, they use spreadsheets for data processing, they use graphs for extracting and mediation of physical information together with graphical derivative and integral. They are familiar with the basics of dynamical modelling within Coach. Moreover they are able to create electronic presentations with video clips inserted directly in slides, since they were presenting their personal experiences at the final presence meeting in PowerPoint.

In an on-line questionnaire they were inquired about their opinion on the course of distance learning in general, studying materials and Coach activities, effectiveness of communication, and

the usage of Coach for education of physics and natural sciences at schools. They were also asked to evaluate the acquired skills of them. They are sure to be able to perform most of the operations without any problems alone, for several of them they would need some experienced help. They varied in their preferences to what activities devote more space in the course either because they liked it, or because they would need more practice in it. They found the instructions in the activities mostly or relatively well explanatory. The topics of their interest were covered from 70 to 90 percent. The communication between the training centre and participants was considered effective or even very effective in solving problems. On the other hand, the communication among the distant learners was very poor, but they regard it only partly necessary. Out of the communication tools chat within NetMeeting was found the most effective, but the electronic notice board, e-mail, desktop sharing and voice communication were popular and efficient as well.

According to the final presentations and discussion it followed that they managed to use computers for physics' education quite well. Most of them worked with it at school with students, either with the whole class demonstrating experiments or selecting a small group of students from various classes in various school years, who were showing interest in it, and working in more or less personal atmosphere modelling different real-life situations or preparing video measurements.

Follow-up

In order to make the whole process of training of in-service teachers in using computers for physics education meaningful as well as in order to contribute to the innovation of teaching methods in natural sciences, also the future cooperation with the teachers would be desirable. We aim to build a database of computer-based measurements, dynamical models and video measurement activities for the disposal of all the teachers of physics. Consequently we would like these teachers to take active part in filling the database with the activities, since they are experienced Coach users and imaginative physics' teachers. We could supply them again with all the required technical equipment. Moreover we can organise there also a discussion platform, where they could share their experiences. These are already two of the future indicators of their successful continuation in the project of distance learning. The other indicators of goal achievements to accomplish in this second phase are this time more oriented on the classroom activities, to reach the maximum students' educational activity.

In addition the Coach users' community is probably going to grow because of the reasons explained below and so could rise also the demand for the distant instruction or tutorial in Coach operation. In coordination with the national project "Infovek", of which goal is to help to transform the traditional school into modern global school of the third millennium by means of information and communication technologies [4], it could be possible to supply a few selected schools already

participating in the project and winning the competition with all the required software and hardware of Coach in perspective of 2 months. The project “Infovek” integrates three main aspects of school transformation. It is concerned in building hardware infrastructure, teacher training and creation of educational material. The teachers of the chosen schools having interest in using Coach at lessons will have an opportunity to attend a planned summer school, but they are also potential distant learners. Furthermore we will certainly open a new course for beginners starting from September, since a few physics’ teachers have already applied for it.

The following term is going to be organised already in an e-learning environment, in order to make the training more professional and hopefully even more effective. We are going to use “Moodle”, which is a learning management system for producing Internet-based course Web sites. It includes activity modules such as forums, resources, journals, quizzes, surveys, choices, assignments and peer-reviewed workshops. Thirty language translations are currently offered, one of them is Slovak already, and more are going to be developed. It is being used by a growing number of universities, schools, and independent teachers for distance education or to supplement face-to-face teaching. Moodle is provided freely as Open Source software“ [5]. The activities of the Department of Physics Education in distance learning of computer-based laboratory are certainly growing in number.

Conclusion

In the period from March to June 2003, a distant course on the usage of computers in physics’ laboratory was held by the Department of Physics Education. Within 12 weeks of its duration the participants managed to acquire skills in handling computer and interface material for measurement and data processing, computer modelling of physical phenomena and for solving physical tasks in real-life situations depicted in video clips. The tools used for the distance communication are commonly available at any university or a training centre, without any special costs for performing the course (except for one-off costs for technical equipment like computers, web cameras, hardware and software of Coach). There have been used ordinary e-mails, web sites, CDs, departmental electronic news board for giving instruction and providing studying materials. For the synchronous communication NetMeeting tools have been used, out of which chat, audio and desktop sharing proved to be very efficient for our purposes. Besides the distant meetings, two presence ones were necessary, the initial instruction and the final presentation and discussion. We have not used any special e-learning system so far, however, it is planned to do so already in the subsequent course to make the education more intensive.

A positive outcome of the course is that most of the teachers applied the new skills directly in teaching learning process, which had already at least a short-term influence on the innovation of

secondary school education during the course. We hope also in the future mutual cooperation with these in-service teachers on the same topic but already on an advanced level. However they used Coach at schools they applied it for a team-work or even the whole class presentation. So it is necessary to discuss the possibilities of Coach in individual students' activities in the next term with them in order to make the students more aware of their learning.

In addition several new projects concerning computer-based laboratory are developing, even in cooperation with other organizations, which is of high importance in the educational sphere.

References

1. Pišút, J., Koubek, V., Innovation of teacher training in physics and maths, TEMPUS AC_JEP 13101-98 , <http://www.ddp.fmph.uniba.sk/tempus/temp001.html>, http://www.ddp.fmph.uniba.sk/tempus/fyz_vzd.html
2. <http://www.ddp.fmph.uniba.sk/~koubek/Granty/Granty.htm>
3. Coach <http://www.cma.science.uva.nl/english/index.html>
4. Infovek <http://www.infovek.sk/konferencia/2000/prispevky/filozofia.html>
5. Moodle <http://moodle.org/doc/>, <http://www.gnu.org/directory/education/adult/moodle.html>