

METHODOLOGICAL ASPECTS OF COMPUTER-BASED TUITION IN MATHEMATICS

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ABSTRACT

The study focuses on some methodological aspects in development and presentation of computer-based tuition in mathematics. The author shares his personal experience in computer-based tuition at the High School of Mathematics in the town of Plovdiv, Bulgaria.

INTRODUCTION

The development of computer technologies is a great social advantage. Recently, these technologies have been widely applied at different points of educational level. Information technologies have been added as a compulsory academic subject to school curricula. At the same time, the administrative management of Bulgarian schools has been largely computerized. Electronic education is quite actively developed as well, with educational web gates and electronic lessons on different subjects [1, 2].

The present study discusses some methodological aspects concerning the development and presentation of computer-based tuition in mathematics. The author shares his personal experience in computer-based tuition at the High School of Mathematics in the town of Plovdiv, Bulgaria.

ON THE ADVANTAGES OF COMPUTER-BASED TUITION

From a pedagogical point of view, interactivity is probably the most important feature of computer-based tuition. We believe that interactive methods in tuition will be consistently and permanently applied in the future because of the following:

- Fast development of computer technologies worldwide;

- Capacity for computer “remodelling” of objects, processes and phenomena;
- Increased interest in computer-based tuition;
- Attractive and realistic computer visuals;
- Cutting out the expensive techniques and printing out visuals necessary for students’ practices on different topics.

Tuition in information technologies (IT) comprises different computer program approaches for the implementation of specific tasks. Practical sessions set specific cases to be solved by students and allow them to apply what they have already studied. It is entirely up to the lecturer to include problems that have been reviewed in other subjects. For example, computer remodelling of various objects, processes and phenomena in biological sciences can be done using already taught skills.

Computer modelling is an important prerequisite for the development of creative imagination of all participants in the educational process. In some instances, teams with both teachers and students can work together on equal basis. Such equity between teachers and students nurtures ambition and creative potential in kids. The tutor can see his followers as ideally creative grownups: ideas are generated to become models; models are realized; and so on.

HOW TO PROCEED WITH A COMPUTER-BASED TUITION?

In this part, I would like to suggest a scenario for a computer-based tuition in mathematics. It is a common view that the most attractive application of computing is in geometry. We will focus on some topics in calculus, which concern the features of various elementary functions. The lessons on functions are among the most favorable computer-based lessons in math. Such lessons can be easily visualized and time is spared for the lecturer to draw graphics manually and make comparisons. Here comes the need for easier teaching with higher percent of understanding students. The lesson may seem hard to be understood by conventional teaching [3-10] and much easier with attractive computer visualizing [1, 2].

The initial step is to devise a project of the lesson with conceptual outlines alongside with the idea for the incorporated visuals. It is the teacher who sets the specific problems and tasks to be solved. Teachers and students meet to clarify the details. The main items of knowledge that should be mastered by the students we call *bullets*. They are set by the teacher.

We distinguish lessons of three types: a new knowledge lesson, a practical seminar or a revision test for students’ control.

It is very important for the project to include any details even if only one part of the studied content has to be presented. Undoubtedly, it is preferable that the lesson plan is also conceptual. Further on, specific tasks for the different team workers are to be set out. The teacher is involved in the lesson methodology, while a student-designer under the supervision of an artist-painter creates the visual idea of the lesson. The main menus, submenus, graphic elements and animation used are to be finalized.

The lesson design has to be in conjunction with the theme of the project and its direction. There follows a precise decision about the choice of software.

The preparation for the lesson is a time consuming process. Every participant has his or her own responsibility for the part of the lesson they are engaged in. After all separate details have been worked out, the whole team has to construct the entire presentation. This is to be conducted by the guidance of the content teacher with the active support of the informatics teacher.

Very often the primary idea and the final result are quite dissimilar. In due course of work, many ideas appear, many are further detailed and the best of what is thought of is thus created. This undoubtedly increases the quality of the lesson plan and is a reason for the team satisfaction.

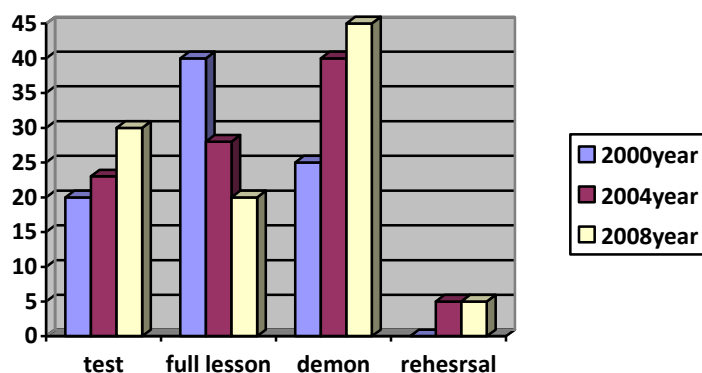
We can draw out the following steps in preparing a computer-based learning:

1. Choice of a topic;
2. Setting a task for remodelling of objects, processes and phenomena;
3. Conceptual planning of the lesson as a presentation;
4. Defining a subject for revision;
5. Defining the lesson type;
6. Choosing teachers' and students' team;
7. Practical sessions to clarify the details and to put stresses on specific items;
8. Methodology of the lesson;
9. Defining the design;
10. Choosing the appropriate software;
11. Technical preparation;
12. Correcting errors;
13. Informal presentation and search for approval;
14. After corrections have been made – a test in front of classes in several consecutive hours;
15. Last corrections or improvements and final adjustment.

Apart from traditional lessons in mathematics, the computer-based lessons can be classified, as follows:

1. For demonstration or visualization of a process (duration 10 min) – visual presentation of part of the lesson, which can successfully replace expensive technique and materials;
2. A lesson for acquiring new knowledge – highlighting the new knowledge items through several bullets in the lesson;
3. A rehearsal lesson – inclusion of a variety of options, even out of the curriculum, to deepen the students' knowledge. It is the most artistic and individual part of the project, which is creative both for the teacher and for the students;
4. A test on the studied content – quantitative measurement of the level of students' understanding and learning;
5. A fully developed lesson as outlined in 1, 2, 3 and 4;
6. Remote lesson – without the actual presence of the teacher;
7. Lessons for children with disabilities;
8. A module when all lessons together form a whole topic;
9. Computer-based course tutorial on a certain subject.

Our own analysis of mathematics education in our school shows that the most attractive and important part of e-based teaching are the demonstration lessons and the tests as it can be seen from the diagram:



The computer-based teaching and learning process creates an option for differentiated approach towards setting the definitions and characteristics. It becomes “armory”, through which the new definitions can be more easily understood by the students, can be compared to the already learned material and

tested by the students themselves. A lesson of that type is entirely complete when it ends with a test. The test questions, the style of the test and the answer mode are an important part of the computer-based tuition. Taking tests stimulates specific features in all students – concentration, reaction speed, etc. It seems quite evident to us that a compilation of different kinds of test systems is also important in acquiring a more detailed analysis of students' knowledge.

METHODS OF LESSON PRESENTATION

Different types of lessons require different approaches. Here we outline only the demo lessons, new knowledge lessons and the test lessons.

The teacher needs to know the software in details. It is not preferable to leave students to get accustomed to the software by themselves. The teacher guides the students to learn it before the lesson starts. A certain task is set out to be solved. The teacher inspects whether all students follow their assignments and helps those that have difficulties. Those who finish their tasks successfully, can receive a new one.

The demo lesson is among the most preferable ones by the students. It requires good computing skills but is one improving designers' features in the students. It does not occupy the whole academic hour, therefore it should be part of the demonstration. The demo lesson with remodelling objects is already a challenge to the teacher and the students. The teacher can give examples and then let the students work alone or in groups.

The new knowledge lesson could be divided into several sub-steps:

- Introductory notes;
- Instruction on how to use the software;
- Practical guidelines on how to use the software;
- Demo of the new lesson;
- Demo of the solved questions;
- Tasks with 'hidden' answers;
- Tasks with hidden solution;
- Tasks to be done in class;
- Task for homework.

These lessons are preferred neither by the students, nor by the teacher, but they have their own impact on the studying and learning process. For the students that have missed some of the lessons, they provide a way to catch up with the material.

CONCLUSION

The application of computer technologies at school is a new branch of their modern development. It is based on the growing needs of computer-based teaching and learning, which are less incidental and much more systematic. However, although for most of the subjects there are ready-to-go lessons, the methodology to put such lessons in practice is not clear yet. Therefore, any kind of experience [11] is welcome by the teachers who need the pros and cons of computer-based teaching experience as a guiding light.

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