ICT TO ASSIST MATH TEACHING
AT PRIMARY SCGHOOLS

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Abstract. Maths teaching has some specific features in comparison with other subjects taught. It is abstract and realistic, accurate and logical and it has its philosophy. Therefore teaching maths requires a more personalised approach, including highly motivating elements. This, in particular, applies at Primary Schools, as the attitude of children to maths is formed at this level of education. It is about the active involvement and creativity of children, which in turn requires a creative approach to teaching by the teacher. The teaching process can be suitably complemented by using up-to-date information and communication technology. In addition to professional teaching programmes developed by specialists, the teacher can apply a different approach by using commonly used software for developing his/her own teaching programmes.

1. Pupils, teacher and maths teaching software

Education and work with information nowadays, in the 3rd millennium, is nearly unthinkable without the use of modern IT and multimedia programmes. Today, children are born into and brought up in an environment where this technology and multimedia applications are common and perceived as a natural part of their lives. Similarly multimedia entertainment and education is quite natural to them. This is the reason why teachers, particularly in primary schools, must be aware that successful teaching must be, above all, interesting for the pupils and meet their expectations.

In maths teaching, there are many motivational teaching programmes, tools and numerous multimedia options. There is a wide range of software programmes available that support very complex tasks. For example equations, formulas, calculation of limitations, derivations, integrals, plotting graphs, modelling, data analyses, testing of hypotheses, construction of 2D and 3D

objects, dynamic modelling etc. However, these programmes are neither cheap nor readily available and the normal PC users (teachers and pupils) are not trained in using them. Sometimes working with these programmes is closer to "developing" new software, which can have a discouraging effect on potential users. Unfortunately, these programmes are mainly targeted at the age group of 10+ years (secondary schools, high schools, colleges and universities).

However, in primary education the attitude of children to education is formed and maths has a very special position in this respect. This is most likely the reason why so many pupils and students have a very negative attitude to maths nowadays, which has very serious social consequences resulting in attempts to reduce the number of maths teaching hours in the education system.

2. Objective of using ICT in teaching

Alternative approaches, higher standards of visualisation and an immediate response to changes in parameters - these are the advantages of adopting IT in teaching, without mentioning its power to motivate pupils. There are many options and approaches for supporting maths teaching in our schools, but these activities are still centred around standalone activities of teachers - ICT enthusiasts - rather than being an educational platform supported by the management of the educational institutions and policymakers in order for it to become an official professional standard.

Let me reflect on this issue by presenting some very simple tools which may be used in maths and other classes taught in primary schools, as at this level of education the approach to teaching is more interdisciplinary and subjects are more intertwined. The objectives should be:

- To increase the popularity of maths as a subject
- To improve the quality of maths teaching and make it more attractive and motivating by allowing the use of IT for homework.
- To support active and efficient partnership between the teacher and the pupil in the educational process.
- To use modern teaching methods (interactive elements in teaching, team work and co-operation, e-learning).
- To develop logical and mathematical thinking of pupils and their interdisciplinary skills.

By choosing the right application, communication environment and the area of maths, which is the most suitable for them, and adoption of a creative approach to the teaching - all this can deliver better quality and a more personalised approach in teaching, which then becomes more attractive and innovative for the children. This can be achieved, particularly, through their

active involvement in the learning process by allowing them to interact creatively with these electronic means. However, such an approach is much more demanding for maths teachers because it requires their involvement, creativity, courage and innovative methods in maths teaching, which can sometimes be risky compared with proven practice.

If we look at official "Framing Education Program of Basic Curriculum" for maths and ICT for primary schools, then it becomes clear that only a teacher with a great deal of imagination or an IT and maths enthusiast is able to combine these two subjects into a single formal document. The question is: How to persuade a primary school teacher to adopt this approach?

3. The user's application of electronic teaching tools

There are many options available for electronic support of the teaching process (some of these means are designed for children as young as three). One of them is to use off the shelf products (e.g.: "Virtual School - Math", "Mysterious Forest" and many others). These products require from the teacher a thorough preparation of the lesson in terms of using them. Although these "teaching" programmes are user friendly they are not well designed from the didactic point of view and very often they lack the necessary feedback, interactive input and other elements of both the teacher's and pupil's involvement. These products also tend to limit the children's creativity.

Another possibility is to have the teaching software developed by a specialist company according to the specification provided by the teacher. In this case the didactic objectives of the teacher are met, but the limitations are the high project costs and frequently experienced problems with the input analysis when the programme developer is unable to see the product with the teacher's eyes and the teacher does not know how to specify the requirements from the ICT perspective.

A preferred option is "in house" development of multimedia programmes. Their quality very much depends on the skills and capabilities of its author. If the ITC teacher is an "enthusiast" then he is able to develop his/her own projects matching his/her personal approach. These programmes have the best value, but very often they can only be used by the author or his/her closest colleagues.

The target group here are the teachers who already use some basic programmes such as MS-Office, Power Point, Presentation, Macromedia Flash, Movie Maker and other simple programmes that can be edited by the user. This is a group of multimedia users who can translate their teaching experience, methods and ideas into the multimedia environment, which allows them to adopt new approaches and teaching methods in a relatively simple

user's environment. However, from the programme point of view, it is not a perfect solution but it has the advantage of universal application, the content can be quickly updated, it is interactive, generally understandable, can be easily distributed to other users including export to other information and communication systems.

It is important for an "amateur" developer of teaching tools to understand the key principles of creating a multimedia programme. In the easiest case it is the creation or transformation of graphical data, text or sound into digital format and their structuring and organisation according to a pre-defined scenario. This exercise does not require any deep technical understanding of ICT by the teacher, it is enough to be computer literate. The key interactive elements of the electronic teaching tool developed in this way are the hypertext links and use of various built-in functions such as the "if" function in Excel etc. This enables development of a template, which can later be filled with data resulting in an electronic teaching tool the format of which can be modified. In this way the teacher can achieve the intended objective, which is a creative approach to exercises on the part of the pupils.

This is an easy way to use "common" programmes in a less common manner and develop teaching materials, presentations, programmes, exercises, worksheets etc. The outcome is an electronic teaching tool using available software products (MS PowerPoint, MS Excel, MS Word, Macromedia Director, Macromedia Flash, Cabri Geometrie, Comenius Logo, Derive, SMath, off-line HTML etc.). This can help to bring a more personalised approach into maths teaching and increase the interest of pupils in maths by using modern methods of teaching and an innovative approach. Another important aspect is that everybody can work at a pace which suits him/her best when learning a new subject, developing logical thinking skills, creativity and the ability to work independently. It is also possible to use interactive links to other freeware products available in the Internet.

Using these teaching materials, and in some cases dedicated classrooms with interactive boards for example, makes it possible to replace the conventional frontal teaching methods with a more interactive approach, team work and co-operation. The software can be made available to pupils and teachers on the school website thus providing remote access to it. This will also improve the interdisciplinary relations between maths and other subjects and will help to fit maths better into everyday life.

When using "non-mathematical" programmes in maths teaching it happens that the direct solution must be by-passed and the approach that reflects the logics of the programme must be used, in other words, to push the computer to give the answers to the questions we are dealing with. It is possible

to use many built-in functions, interlinks and process dynamics. Looking for alternative ways, a high level of visualisation and immediate response to changes in parameters - these are the advantages of using computers in teaching. Another efficient method is the development of teaching projects using HTML protocol for web presentations including off-line web pages in the form of e-books. At the moment this solution provides very good transferability and independence on the software platform and therefore it can be used at nearly all computers, as the Internet browser is a standard programme in every computer. Hypertext interactive navigation plays an important role in this solution. It is obvious that it is easy to use a multimedia presentation created in this way, it does not require any special computer skills and in combination with other methods, it can comprise more motivating elements, handle the traditional teaching contents in a more interactive way and present old "subjects" in a more modern fashion.

Another important element is the fact that addressing these issues can be done in collaboration with other colleagues, students from teaching colleges who can participate in the development of electronic teaching tools during their practical training at a school where they can co-operate with the relevant teacher or they can develop these topics in their graduation thesis.

4. Conclusions

The biggest issue in terms of the development of electronic teaching tools is the conservative mind-set of people-teachers and their personal belief in potential usefulness and advantages of multimedia and ICT as established by many years of research. Their frequent argument is: "Kids understand these things, but it is not for me, ... ", "I do not understand this technical stuff, ... ", "Computers steal time and are harmful to health, ... ", ".. chalk and blackboard will do for me... " etc. These arguments are natural as they strive to maintain the existing situation without any significant changes, to keep the existing status quo.

If an adult is systematically adopting computer skills and becoming familiar with ICT it is not a childish entertainment of clicking through, but it is a serious learning process aimed at mastering this kind of technology. The targeted and accurate communication of the project makes the difference that distinguishes them from an intuitive, memory based approach of children to this technology.

In the same way, communication materials where there is no mouse clicking can be developed as part of the teaching project in order to boost the pupils' creativity and thinking. The active involvement of pupils helps them gain a better understanding of mathematical principles, they can try everything, they

are not only passively receiving the information but they experience the joy of "exploration", which is the biggest motivation. Inspiring teaching based on a constructive approach aims to develop the mathematical thinking of children through a wide range of mathematical activities. The teacher concentrates on the pupil, his/her understanding of relations and how the acquired knowledge is applied and used by the pupil. The teacher seeks for, and incorporates into teaching, such ideas that help the pupil with a better visualisation of the concepts and phenomena taught and understanding of the process and relationship.

It is obvious that this method develops pupils' creativity but it is also demanding in terms of teachers' personal involvement and creativity.

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