ICT and Multimedia in Primary School

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Introduction

This study is a three-year investigation of the effectiveness of learning in multimedia environments. Test projects in six Austrian primary schools were followed and documented, and the study design, theoretical foundations, and results are discussed below. Details can be found in the book "Neue Medien in der Grundschule, Unterrichtserfahrungen und Didaktische Beispiele", Ueberreuter Verlag, 2000.

Aim of the Study

In the year 2000 every single primary school in Austria will be equipped with computers and Internet. The aim of the study was to start fresh impulses for new learning methods in primary schools by developing a model for using computers and networks. The evaluation points out the efficacy of using computers in conventional teaching, in phases of open study peroids and partly in afternoon care with groups of children choosing additional voluntary ICT training.

The outcome of the study provides guidelines for school authorities concerning requirements of hardware and software, teachers training curricula as well as may serve as a model for ICT guidelines for primary schools.

Teachers should be provided with methodical and didactical concepts on efficiency of learning with multimedia applications and examples for practical work..

Remarks on the Austrian school system

In the Austrian school system compulsory primary schools are for children aged between 6 and 10, and the use of computers has not been part of any curriculum during the past (and computers have been almost unavailable in schools). In the curriculum of the secondary school (age 10 14), ICT has now been established for ten years.

Study Design

Participants

In agreement with the Vienna City Administration and the Education Board of Vienna of the Federal Ministry for Education and Cultural Affairs, six primary schools (see table below), accompanied by two trainers from the State College for Education in Vienna (scientific research assistants) and a project leader from the Federal Ministry for Education of Austria participated in the project.

Primary School	Classes	Teachers	Pupils
1, Graz Goesting	2	2	35
2,Vienna, Aspernallee *)	4	4	90
3,Vienna, Ettenreichgasse	2	1	41
4,Vienna, Herderplatz	5	5	112
5,Vienna, Oberlaa	8	8	127
6,Vienna, Waehringerstr.	2	2	43
Total of six public schools	23	22	448

*) full time public primary school

Homepages

- goesting.volksschule.at
- www.schulen.wien.at/schulen/902011/index.html
- herderschule.pcnews.at
- oberlaa.volksschule.at

Time Schedule

The three-year study (six terms) started in late autumn 1997. The final report was published in October 2000 together with a CD-ROM (including examples of products generated by pupils and teachers).

Equipment

Provision of the required hardware and software came from federal budget funds (multimedia-PC's, Internet access, Microsoft Office licences, graphics software, interactive educational software, and programming software). A minimum of two computers (up to four), in most cases multimedia computers (Pentium II) with color printers and Windows 95, is situated in every classroom, turned on in the morning and available for use during the whole day. In addition, every school has a special computer room (8 or more computers with Internet access).

Accompanying Support

Numerous meetings for the purpose of training teachers in, e.g., scanning pictures, web publishing, and programming with authorware systems have been arranged. Technical support was provided. Besides the official training, some teachers took voluntary special courses, which are part of the study plan of the State College for Education of Vienna (six hours weekly over a whole year).

Questions

- How can computers and networks be used with pedagogical impact
- Can the use of computers provide better learning outcome
- Can the use of multimedia software and new ways of learning with networks help to achieve the ability for lifelong (guided) learning
- How can the use of ICT change learning methods and organizational models
- What could be recommended for the federal ministry to improve teachers' education systems.

Methods

- Measurement of expertise in using computers at the beginning and the end of the three-year study (teachers and pupils)
- International literature review on the foundations of learning theory
- Studies of the effectiveness of multimedia resources in learning environments
- Investigations of the development possibilities of multimedia learning environments
- Audit and analysis of numerous lessons (by the project leader and teachers' trainer).

Teachers have been invited to do practice sessions in classes with specially experienced colleagues in other schools.

Theoretical Foundations

Education in primary school is rooted in basic experience. It is holistic and action-oriented, and should provide learning by discovery. It should allow every single child to find his individual way of learning, and also to follow individual lear-

Abstract

The paper outlines the result of a three-year research project concerning the use of multimedia and ICT in primary schools in Austria.

The aim of the study was to evaluate the efficiency of learning with multimedia applications (offline products e.g. CD-ROM, user software e.g. word processing and presentation and Internet) and to develop didactic models for learning with new media as well as a model for an ICT curriculum for primary schools.

The use of multimedia learning environments in the classroom requires special knowledge. Teachers need technical support as well as didactic models to introduce users to software and learn about new aspects of learning theories in combination with learning with new technologies.

Keywords

Multimedia in education, ICT skills, Internet in the classroom, learning theory of constructivism, drill and practice software, methodical and didactical concepts, efficiency of learning with multimedia applications, examples for practical work..

ning goals (learning method of constructivism).

Central aspects are interactivity, individuality and information and communication without borders.

Reality is in our heads, and reality is cognitively constructed. Knowledge is not an integral replica of reality. Learning is an active process based on the motivation of the learner. Learning means self control and self direction. Learning is a constructive process of every single individual. Learning takes place in specific situative contexts. Learning is a communicative event and is culturally influenced.

Constructivism means (relative to computers) that training has to be embedded in meaningful context.

Computers can support the learning process if the teacher takes over part of the organizing and is a partner for communication and helping in the learning process.

Repetition has to be in conjunction with new, diversified experiences chosen by the learner.

New learning environments require a new learning culture, which means extending the concept of learning and efficiency. Constructivism brings into play the introduction of skills and new notions of competence. Learning has to be an active, constructive, self-directed and communicative process, applying the factual competence of learning, drawing together individual pieces of knowledge, being able to make decisions based on facts.

Organization of Instructional Materials

Structure	Method	Software
computer-assisted learning	demonstrate – copy; teacher-centered	drill & practice, learning games, tools
computer-based learning CBT	trial and error, exploring learning teacher-oriented	tutorials, simulations
computer-managed learning	constructive, interactive	hypermedia, author software

- Computer-assisted learning means that computers just support the learning process. Single pupils or groups receive additional material and educational software for short-time working phases. The goal of the educational software is clearly defined for repetition and to retain knowledge.
- Computer-based learning means more impact for the learning process of the pupil. Software provides more information and leaves more freedom of choice concerning the way of learning.
- Hypermedia learning environments (computer-managed learning) offer benefits for exploratory learning. Teachers help in organizing and providing materials, they are coaching in solving problems (use of the program).

They like to use digital cameras to document situations at school or during school projects.

Preferences in using different applications are shown below: The bars represent the percent of boys and girls out of the study group classifying the specific application with "very much appreciated".

Multimedia educational software

In the very beginning the use of multimedia educational software was the center of interest in classroom teaching. It turned out that the most important objective is to find the appropriate software. It has to be taken into consideration, that even if there has been some evaluation process in advance (based on software guides for educational products), the acceptance of a single product differs in a wide range depending on the individual teacher's demand.

Evaluation of the product has to be done carefully. Programs structured around drill and practice stem from the learning theory of behaviorism, which does not reflect the advantages of constructivistic learning theory.

Observational analysis (picture-, reading- and hearing perception) has determined that there is no difference in memory achievement between using computers or traditional media. These results should not lead to a shortsighted conclusion. Memory (perception using different channels: audio, video and text) is just an integrated part of learning. In context with "learning with fun" and the aspects outlined in section on Theoretical Foundations the software must act according to the proper learning model.

The main point is not, if learning with or without multimedia is more effective, it is, on what learning concept the software is based, and how the teacher organizes the process of learning.

The development of quality criteria for evaluation of educational software was part of the study. Additional criteria for designing appropriate learning systems (multimedia products) and what has to be taken into consideration for developing and producing educational games and software are part of the final report of the study "Neue Medien in der Grundschule")
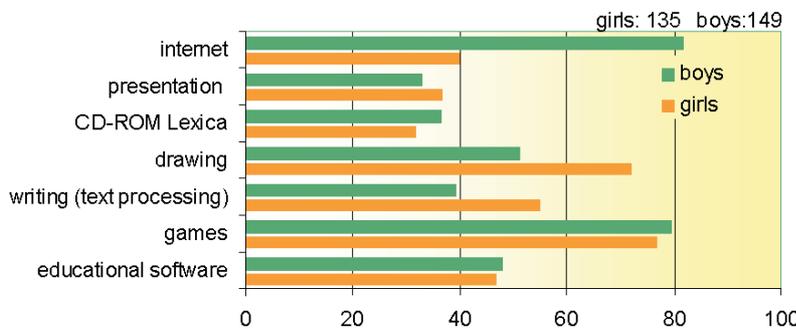

girls: 135   boys:149

Figure 1: Preferences in using different applications

Competence in methods, working techniques, procedures and learning strategies, use of situational relationships and goal setting are required. Other goals are learning social competence concurrently and taking responsibility, knowing and managing individual competence from individual abilities and strengths.

Constructivism leads from group- to student-centered teaching, from the teaching of facts to the self-organized acquisition of solution-oriented knowledge and is changing of the teacher's role from advisor to coach and mentor.

Outcome

Goals reached using ICT are mostly achieved with more fun, and are effective, if the teacher can provide appropriate software and manage the organization in the classroom. Learning by using educational software gives more freedom to choose the way of learning. Teachers take care of time management. Multimedia learning environments allow achievement of content using different channels of information (visual, audio, textual signals), and provide interactivity.

Most impressive was the creativity of children and teachers. Pupils in this age group mostly like to work with text processing and graphic software including animation, to illustrate their worksheets for elementary science or project reports.

Lexica, electronic books and WWW

In elementary science CD-ROM cover a wide range of use of computers. More and more time is reserved for project oriented learning. Some examples (topics) covered by project learning in our study were

- The woods
- The sea
- The human body
- The city center (traffic, history)

- Magnetism
- Animals on a farm
- Advertising.

Using Internet access, teachers provide a list with bookmarks in the first and second primary class to give children a shortcut to be successful from the start. Pupils work together in small groups organizing themselves. They are able to download text and pictures, comment on material they found and include pictures, text and files in their worksheets. They can obtain much more material, mostly in different graphical forms than with conventional methods. And they can integrate graphics to illustrate their work in a timesaving and simple way. They very much enjoy copying pictures into their reports, and cutting and pasting parts of graphics (see below). Graphics are the most important in "working with fun". Videos integrated in the lexicon (or in the WWW) can explain related facts, and simulation can give more insight into processes which cannot be easily explained in traditional ways.

Word processing, graphic software, software for presentations

In the first two years in some classes reative Writer or unior Writer are used for text production. Some teachers are introducing MS Word from the very beginning to the pupils

Some like to write their weekly school exercise by typing into the computer instead of hand writing. Others enjoy Wordart for structuring a worksheet (instead of handwriting). Creative writing is also a favorite for some children. Also enjoyed are the possibility for choosing different types of fonts, colors and sizes, and last but not least frames and graphic options. Some classes are producing comics instead of common reports for some reason.

Various graphic software is in use. Pupils' work products now involve playing with words and layout, not only writing.

Scanning pictures and photos, use of digital cameras

Drawings and photos are scanned and included in presentations and reports of projects. As mentioned above, graphics and pictures are of most interest, and with digital media pupils can include their individual preference (photos of themselves or their friends) into their products. Hand drawings are produced and afterwards scanned and integrated in school-newspapers. One of the most popular projects was the production of a T-shirt with a special picture on it. The pupils drew a picture by hand, and also designed a school logo. The name of the pupil, the picture and the school logo were printed on the T-shirts .

Authoring software

Some classes are working on projects for production of a CD-ROM with Mediator (authoring software). An example of a third-year project: every pupil had scanned a photo, written a anted description and a little poem, scanned his signature and digitalised his voice (speaking a riddle or poem).

The production of multimedia, especially the production of a school newspaper or a school-CD-ROM, often involves teamwork on computers by children out of different classes.

Homepage, Mailing

Every school is present on the web. In some schools, teachers are publishing pupils' productions to the website. This allows everyone to see what is going on in school. The pupils' requests sometimes push the teacher to publish their excellent products on the web. Children like to show what they are able to produce to the world. In some classes pupils mail special productions to their parents' e-mail address.

Using e-mail for communication is common only in three classes. In a special case a fourth-year class was communicating with a Swedish class in English.

Organization (Using Computers and Networks)

Two computers in one classroom, called "computer corner guarantees that the computer can be used when one wants to use it. This is a great benefit for integration of computers in learning. Two pupils together with one computer can often be more creative.

Figure 2:Two children working together using one computer

A classroom teacher makes it much more efficient for every pupil to achieve competence in the use of computers and to provide educational software for the specially talented. In open learning phases the computer is one station of the day's program for every pupil. In some cases some differentiation is made in the program (individual support for deficits or advanced exercises). Experiences depend on the age and the specific projects, and if there are special resources for afternoon care. Some children need much more help in using computers, which can be provided by other pupils or by an additional teacher.

A second teacher in the classroom makes it much more effective to instruct pupils in the use of computers, scanners or new software (team teaching). Teamwork (team teaching) leads to increased creativity in classroom teaching.

In some schools there is additionally a so-called computer room (eight or even more computers). This is often used for afternoon care or voluntary courses for different kinds of ICT use and in project phases.

Conclusions

- Multimedia and networks can benefit learning in a way that leads to more self direction and self control in the learning process.
- The learning outcome is based on exploitation and interweaving of multiple sensory channels. This could increase the ability to correctly evaluate and use information.
- Using multimedia software and learning with networks can change learning methods. The interactive learning process arising from using educational interactive software can in turn lead to learning methods which have lifelong value.
- By teaching ICT skills in primary schools the pupils are prepared to face future developments based on proper understanding. Organization of learning must ensure the ability to use communicative, explorative and creative learning environments.
- Integrating ICT skills and new learning methods has a strong demand in integration of didactic concepts in teacher education and in-service training for primary school teachers.

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