

Application of Multimedia Technologies in Pre-School and Elementary School Language Education

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Abstract

The processes relating to application of the modern Information and Communication Technologies (ICT) in the education of the specific target group: children of pre-school age and pupils in the first year of elementary schools are discussed in the paper. New pedagogical approaches and methodology supporting effective and flexible application of the new generation of ICT in language education of children of pre-school and elementary school age are presented and described.

The IP Multimedia Subsystem Next Generation Network architecture (IMS NGN) is used as the platform in the e-learning or m-learning process (e/m-learning). This platform can provide wide spectrum of multimedia applications and additional multimedia sources supporting educational process.

1. Introduction

European Information Society 2010 (Initiative i2010) takes great emphasis on participation of the whole population in this initiative, as well as in the acquirement of the basic digital literacy of the whole population.

Evaluation trends in the area of the Information and Communication Technologies in the last ten years focused on the convergence processes which have led to actual IMS (IP Multimedia Subsystem) NGN network architecture. The specific phenomenon of these modern ICT is that they address the wide spectrum of professional and public community. In other words the ICT address and in the significant way influence the life of the whole population.

Pre-school and primary school education has its specifics related with skills and abilities of the children. The most important fact is that the users are children who can't read and write. This specific fact has to be considered and kept in mind during the whole projection of e-learning environment. The following conditions and aims could be defined in these points:

- Children can't focus their attention to activity for a long time
- Requirement of involvement in the activities of large number of children
- Supporting a relationship with modern ICT
- The need to lead children to the proper use of ICT.

The main specific attributes then define important features of e-learning environment, especially the user interface:

- Visually attractive interface
- The strong accent on alternative control methods (touch, voice)
- Supporting a wide range of multimedia and multimedia applications
- Education by play

- Support for personal and device mobility

The core element of every e-learning environment created in multimedia classroom is interactive whiteboard. Whiteboard belongs to basic equipment of every classical classroom. The opportunities of the interactive whiteboard (IW) in the educational process are discussed later in this paper. IW with its features and abilities contributes to make the whole educational process attractive for the children. [1]

2. Modern ICT and Educational Process

The Interactive Whiteboard (IW) as the centre component of the whole architecture in the classroom fulfils mainly motivating role in the educational process. The Interactive Whiteboard:

- offers new innovative ways how to build a lesson
- uses different educational instruments (maps, posters, tables)
- increases interactivity in student-teacher relationship
- supports motivation, creativity, self-activity and critical thinking of students
- supports a team work.
- enhance inter-subject connections

Although IW itself is the most attractive part of the whole concept it should be connected to the complex network interface architecture to provide more complex and value added functions. Some vital aspects of this architecture are proposed below.

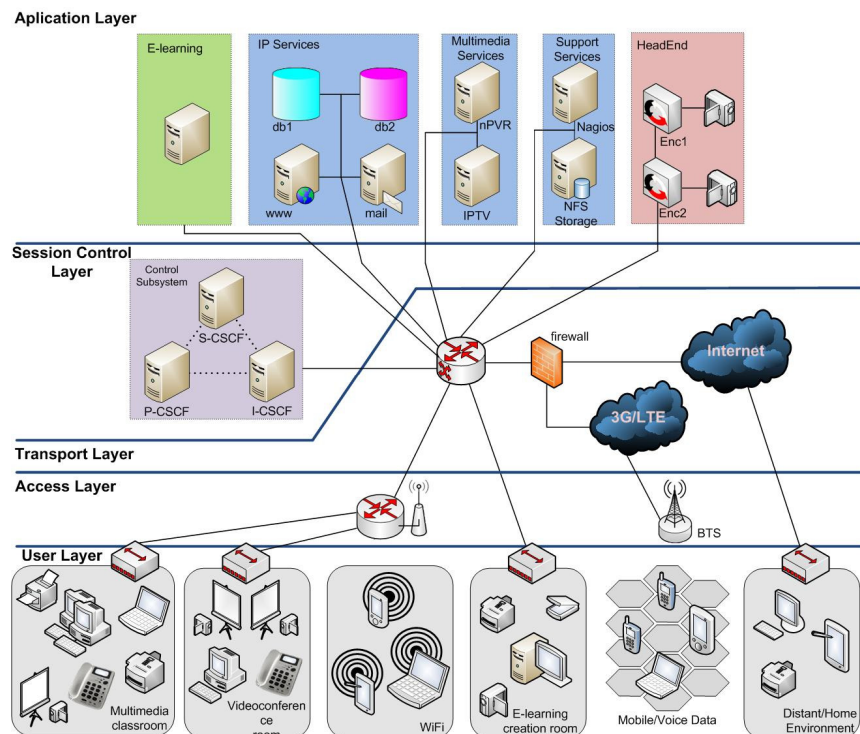


Figure 1: Global architecture of e/m-learning environment for pre-school education

2.1 Components of the architecture

The configuration of the global architecture for e/m-learning environment for pre-school education is illustrated in the Figure 1. The IMS based standard architecture [2] has been chosen, because IPTV is offered to be integrated into this platform and education process for its rich multimedia content. It is necessary to insert the CSCF (Call Session Control Function) into the architecture because of the chosen IMS architecture.

2.1.1 Application layer

Application layer contains segments of network grouped into logical clusters. IP Services group is necessary in every serious network platform nowadays. It contains web and mail servers. A database needed for user management and other related functions is a condition for the platform operability. The database is redundantly backed up for security reasons. Multimedia Services group is related to IPTV and nPVR functions which are required for its rich multimedia content abilities to enhance the learning materials [3]. Support Services group consists of functions connected with management of entire platform and RAID Storage space used by entire system. E-learning subsystem also needs disk spaces for publicized materials. It is necessary to provide high-level reliability and security of stored data so RAID 5 or 6 should be considered. HeadEnd part of application layer is just a part for complexity of the whole system which moves the platform one step further. It consists of cameras and/or encoders which could be used to integrate external video streams into network or create streams using cameras to host remote talks.

2.1.2 Transport layer

This layer consists of the main switch of the whole platform. It is recommended to use manageable switch with reasonable bandwidth to ensure reliable operation of all network segments. The connection with outside world is a necessary part of the whole system. Wired connection to the Internet is absolute must-have ability for the network platform. The connection to the high speed mobile data network of 3rd (3G) or 4th (LTE) is a good choice to support users using the platform in a personal mobility manner. Mentioned mobile connections offer sufficient bandwidth to provide reliable services. The transport layer contains the complex infrastructure needed to provide services from upper layer through access layer to equipment in the user layer.

2.1.3 User layer

This layer contains the equipment and infrastructure directly used by users accessing platform services. It is grouped into classes depending of place or type of function. All classes are analysed in details further in this part.

Multimedia classrooms: The multimedia classroom is an essential part of the whole platform from the user point of view. It consists of an interactive whiteboard which stands for the most important part in educational process placed in the room. Mentioned whiteboard is able to be controlled by touch which could make the whole education process more active and interesting for children. Placing other computers equipped with touch pads, touch screens or even speech recognition software to the room can fortify children imagination and creativity, and show the work on computer in a very friendly manner. Multifunctional device and SIP telephone placed in the classroom only makes the set more complex and user friendly. The whole proposed configuration of multimedia classroom is illustrated in Figure 2. MM classroom contains also microphones situated around whole room to satisfy requirements on quality of audio inputs for speech recognition software.

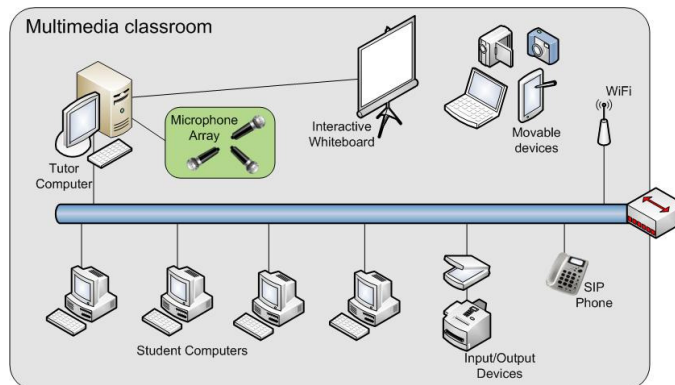


Figure 2: Detailed configuration of Multimedia Classroom



VideoConference room: Videoconference is one of the supporting segments of the platform. It could be used for plain conferencing with distant teachers, or in connection with HeadEnd part in application layer it can create a multimedia video sessions with distant school or similar. It is also one part which makes the whole platform more user friendly.

WiFi zone: This segment of platform is closely connected with personal mobility in a local area in the "campus" of the school. Personal mobility can also fortify creativity and activity during the lessons.

E-learning creation environment: Creation environment is an element of the network used to design and create new e/m-learning materials. This environment could be solved as a separate hardware equipment or just as a bunch of software useful in the creation process. Some examples are Adobe Flash, Toolbook [4] and others.

Mobile/Voice Data: Mobile data element illustrates here an opportunity mentioned in the transport layer. Mobile data connection achieved a great success in the development of bandwidth which makes it sufficient enough to provide reliable connection. This opportunity opens a wide spectrum of applications during walks and other activities.

Distant/Home environment: This part of platform enables similar opportunities as a previous mobile data element, on a wired basis. Lessons or other e/m-learning materials can be executed from home or a similar distant environment.

2.2 Alternative interfaces

There are many different methods how the whole architecture could be controlled, maintained and operated. Technical and other professional operations are out of interest of this paper and have to be done by conventional methods. The specific target group of users puts the problem of user-friendly interface to the top of the priority-stack. The most significant, and in some cases the most bounding feature of the children in nursery schools is their inability to read and write and the lack of concentration for longer time. This feature significantly narrows the applicable interface options. Touchscreens are one answer to the given boundary, although less innovative, but still useful and applicable. The speech recognition software is the most innovative and challenging approach for its great advantages. Speech recognition brings new dimensions to educational process. Reliable and real-time speech recognition of tens of words with standard hardware accessories is from technical point of view a feasible problem. The application of this type of interface requires some specifications. Microphones are at the beginning of the data path, so is it important to pay them a sufficient attention. When using the IW in a nursery we have to take into consideration quite high number of the users (children) who are present while working with the IW. Since children are often quite noisy, some type of quick and comfortable activation/deactivation mechanism for the voice human-computer communication has to be implemented into the ICT platform. Special directional microphone arrays serve as a reliable voice sensor in the given specific children environment. The teacher thus can avoid undesirable reaction of the IW.

Examples of Usage of ICT

We would like to propose here some examples and educational activities, in which IW and other multimedia can be used and offer improvements of educational process (Figure 3). These examples are created for English lessons, but could be also transformed into activities during other lessons.



Figure 3: Illustrative photos of Interactive Whiteboard use

2.3 Pictures

2.3.1 Widening of vocabulary

One of the easiest ways of using the Interactive Whiteboard during English lessons is for widening vocabulary. The IW serves as a motivating and entertaining unit. IW for example shows a group of animals and children should choose one which doesn't belong into the group. Another alternative is when the IW makes a sound of an animal and the children should guess to which animal it belongs. Whiteboard offers also the function of speech recognition, which enables interactive exercises when the children say a word and the IW reacts with a voice evaluation. The children can fulfil some tasks and compete in teams. Alternatives of this usage are infinite.

2.3.2 Use of voice

The IW can be used also for training of spoken English. The exercises could be also focused for example on animals. IW gives a simple question or orders like "Where is the cow?" and a child answers by pointing the cow on the board. The IW can also show plenty of clothes and gives orders like "Put on a red skirt." The children should find a proper skirt and put it on a picture of a girl on the board. Similar examples could be used for different areas of vocabulary (food, parts of body, etc.)

2.4 Still camera

Children can take pictures according to the teacher's instructions during a walk or a visit in ZOO, town or a trip to the forest. These photos can be projected on IW and serve as an object for further discussion or simple vocabulary learning. This function can be enhanced by a possibility of drawing on the photographs by the children. This function could contribute to the development of creativity of the children. Taking pictures during other subjects at school as e.g. biology, geography, or art can also serve for improvement of the inter-subject relations. Children can also take pictures of their family and speak about its members to the rest of the class during the lesson.

2.5 Audio educational materials

The teacher can use the board for playing simple English songs or poems which are chosen according to the aim of the certain lesson. The songs are usually joined with a physical activity shown by the teacher.

2.6 Audio-video educational materials and movies

The board can be used also for projection of audio-video educational materials which can help in the educational process. A teacher can also play a fairy tale or a movie in the English language to children. They can stop the projection together and discuss or interpret the story or certain interesting moments.



2.7 Camera

The video recorder can be used for filming the children's conversations. Children themselves can film their schoolmates and can project the material on the IW. The recorded conversations could be corrected by the teacher or the children themselves.

2.8 Videoconference

The IW can be used for a videoconference with children from an international partner school. A videoconference is a very interesting means for a conversation with native speakers. It is also a very motivating unit in the educational process.

2.9 Sheets of the board

The board enables to work independently on several sheets at the same time. The teacher gives a task to a pupil who opens his own sheet. The pupil can even use his voice as an order to open the sheet. Then the teacher gives another task to another pupil who also opens his own sheet. Thus can all the students have their own sheets during the lesson which offers new possibilities for examination of the pupils or could be used as a competitive element between teams in the classroom.

2.10 Open Problems and further propositions

In the development process of new educational materials (and various supporting multimedia applications) it is necessary to focus on more effective usage of the offered parameters and tools by the modern ICT (as for example the IW in connection with suitable interfaces of human-computer interaction, e.g. voice interface). Regarding the mentioned facts it is necessary to develop or modify educational methodologies and pedagogical approaches for this age category. Main open problem from technical side is a lack of software complex enough to incorporate all proposed functions in one suite. There are separate solutions for speech recognition and e-learning materials development. It is required create such a program to connect these standalone solutions. Proposition of this system is in paper [3]. Also special attention has to be paid to design process of the multimedia classroom to satisfy requirements applicable both for education process and technical needs.

Acknowledgment

This paper also presents some of the results and acquired experience from various research projects such as NGNlab project [5], European Celtic-EURECA project Netlab [6], Leonardo da Vinci projects: ELefANTC [7], MLARG [8], AV project: Converged technologies for next generation networks (NGN) No. AV/4/0019/07, Slovak National basic research projects VEGA No. 1/0720/09.

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