

New Technology and Multimedia application in engineering teaching in Africa

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Abstract: Education is always a matter of great debate. Research undertaking in education employs a wide variety of methodologies, which can be divided into two methodologies: the sequential methodology and the concurrent methodology [1]. There can never be any really adequate substitute for direct hands-on learning as in lab experiments. However, the rapid development of the Internet, wireless network and multimedia based on motion video, allows us to anticipate virtual places and to access support learning communities at anytime and anywhere. This can do a great deal to accelerate the remaining portions of the learning process. This paper tries to unify sequential and concurrent methodology for Africa engineering teaching, by examining their advantages and their drawbacks, and a mixed methodology model is presented using the above recent developments which one appropriate to the teaching of engineering today.

Keywords: Internet, Wireless Networking, Multimedia, Motion Video, Teaching of Engineering

1 INTRODUCTION

The future of each country or Nation is depending of the efficiency of his education. The nature and purpose of educational research is the subject of ongoing debate not only in the columns of educational journals but also in the seminar rooms and at conferences where the findings of research into education and educational processes are presented. The research enterprise in education draws on many disciplines and employs a wide variety of approaches to investigation, but this research activity has a unity of purpose and a unified epistemological basis that demands the rejection of alternative paradigms of inquiry. Popper and Eccles (1997) have distinguished between three different worlds involved in human inquiry [1], [2]. The entities of the real world which include physical objects, as well as the various structures created by human society and which include schools and universities, make up World 1. The world of subjective experiences comprises World 2, which includes individual

mental states, such as the state of conscious thought, and psychological dispositions, as well as the unconscious state of mind. Wisdom is an entity in World 2. World 3 has been created as a new objective world that is the product of human minds it contains not only the corporate body of propositional knowledge concerned with causal explanation, but also the works of art, music and literary writings that are part of the world of shared knowledge.

The body of propositional knowledge that has been assembled by the natural sciences is used to transform the real world through technology. This world has been the field of research and development in the physical and biological sciences acting through technology that has advanced the standing of scientific inquiry.

With the advent of instructional technology, it is necessary to determine whether the technology is actually a more effective teaching tool than traditional teacher centered instruction [3, 4, 5]. However, any teaching methodology in the field of engineering must enable students to construct concepts and develop attitudes. The construction of concepts requires what Piaget calls empirical abstraction and reflective abstraction. The use of education methodologies can be divided in two approaches: the sequential methodology and the concurrent methodologies [2], [6]. The difference between the two methodologies is due to the fact that the two methodologies correspond to two different concepts of knowledge and learning. In this paper we try to improve the above methodologies using the recent development of video and multimedia technology. Though no technology can replace the teacher, it can be substituted to improve the education.

The objective of this paper is to investigate new teaching technologies based on recent developments of video and multimedia technology that, in a sense, could be part of the educational aspect of the "knowledge factory." [7] this new method can reduce the high difference of level between develop and developing countries; use wireless technology the proposed method can be extended in inaccessible areas of

Africa and other, likes the villages.

However, the impact of technology on informal networks of scholarly communication or "invisible colleges" also merits attention. In fact, the changes in scholarly communication are coming more rapidly along these informal channels.

The balance of this paper is the following: in the next section we focus on the two methodologies used in education, the necessity to unify these methodologies, and the improvement of education through the use of Multimedia. In section three, which is the main part of this paper, we focus on the concept of multimedia application in education. First we give a brief introduction of the previous work of multimedia application in education, and finish with our concept of multimedia for education configuration. A discussion will be proposed through some series of steps like the Multimedia DataBase Management System (MMDBMS) (see figure 1.1), the virtual work space for education (see figure 1.2), and the transmission of the audio-visual data (see figure 1.3). Section concludes the paper.

2 COMMENT ON METHODOLOGIES

All research into educational problems necessarily lacks secure foundations in the real world [4, 5, 8], since what is observed is influenced by the theories that direct the observations being made. There is need in educational inquiry to reorient the issues addressed not to be foundations for the observations but rather to the consequences of the observations. The first of the two mains methodologies used in education, is the sequential methodology, which conceives knowledge as a list of subjects that will be required in an engineer's career to solve all the problems he or she is likely to meet. That is: an engineer should be prepared to solve all the problems in his or her area. Alternatively, the area is defined by the list of problems the engineer will be expected to be able to solve, and knowledge by the contents required to solve the problems in this list. Inevitably, the list of problems is defined in the present, at best, whereas students will work as engineers in the future. Sequential methodology implicitly assumes that it is possible to superimpose "true knowledge" on previous student concepts by means of argumentation that considers only the new content. It is a variant of the model that see a student as a tabula rasa, on which anything can be written. It has no need for continuous feedback or for the shock of the real world (counterexamples). Second, the concurrent methodology, sees knowledge as the ability to identify problems and to know how to look for (or develop) and study the contents and protocols for solving them. This knowledge includes an original content necessary to present the problems and to give a direction to the search, but not the entire content included by the other methodology. And there is no attempt to

draw an exhaustive list of what will be useful in the future. Also in concurrent methodology, students learn by themselves, as their alternative concepts clash with reality and are restructured in confrontation with the problems they are required to solve, so that the external contents are finally integrated into their inner world in a reflected way.

Late twentieth century thought has given rise to scholarly activity that questions any attempts to build a unified body of knowledge. From their different viewpoints, comparative educationists everywhere have accepted the challenge of helping to advise on the formulation of educational policy. At an expert's meeting in Hamburg UNESCO Institute for Education in 1955 the role of comparative education in the planned reform of education emerged as a topic of considerable interest refer to UNESCO new methodology of engineering education.

Informal scholarly networking is moving from physical locations in conference and research centers into "cyberspace," the virtual space created by electronic networks. Computer conferencing represents a further step toward recovering the interactivity of face-to-face communication while maintaining the gains in permanency afforded by textual communication.

The gaining of knowledge, from this perspective, ceases to be an end in itself. Because there are many different perceptions of the real world, there are many different versions of reality. The version of reality under consideration at any particular time is seen as relative to the perspective adopted. Further more, Relativism, argues that knowledge is tested by experience through the senses and introspection, and Rationalism argues that reason underpins human knowledge [7], [9]. So the following concept of multimedia application in education that we develop in this paper, allows more flexibility to teachers to experiment then preferential methodology.

Our motivation for using multimedia technologies in education is the belief that they will support superior forms of learning [10, 11,12]. Advances in cognitive psychology have inculcated our understanding of the nature of skilled intellectual performance and provided a basis for designing wholesome learning environments. There's now widespread agreement among teachers, educators and psychologists that we acquire advanced comprehension, reasoning, composition, and experimentation skills not only by the transmission of facts but also through interaction with content.

3 CONCEPT OF MULTIMEDIA APPLICATION IN EDUCATION

3.1 INTRODUCTION

The concept of multimedia has been introduced in education these last decades like the Internet Video-on-Demand, Digital Video Library and so on.

Nowadays many researchers consider the development of communication channels and bandwidth as the most important parameters for multimedia application in education. Internet protocol version (Ipv6), asynchronous transfer mode (ATM) and wireless technology are among the latest developments in this area. Several authors have focused on the application of multimedia in education. For example Fernandez et al [14] summarize the experience they gained and the results they achieved by developing, testing, and evaluating multimedia distant education applications running over an Ipv6 and ATM based broadband access networks. They adapted a set of distant education applications, including a digital-video Library, virtual workspace, and video and audio-conferencing tools to works over Ipv6. Their article reports the technical performance of the network and it's applications. Costantini and Tainard [15] discuss a novel approach to promoting interactivity and collaborative learning for industrial training of designers using the Distributed Building site Metaphor (DBSM) that provides distribution services for sharing a virtual world. The authors propose different collaboration styles such as tutoring of the design environment, case exploration, distributed explanation, mutual learning, distributed tutoring, real-time, and so on. Moreover, the article shows how mobile learners automatically integrated their offline works to achieve a collaborative lesson. Day, Liu, and Hsu [16] look at using multimedia in a comparative training environment. The article presents an automated authoring method based on a formal specification for dynamically generating ISO DSSSL (Document Style Semantics and Specification Language) document styles. Rodriguez et al [14] discusses the relevant parameters considered in the development of a physics video-based laboratory. Tokuda et al [17] details the development of an efficient diagnostic system for an interactive intelligent language tutoring system.

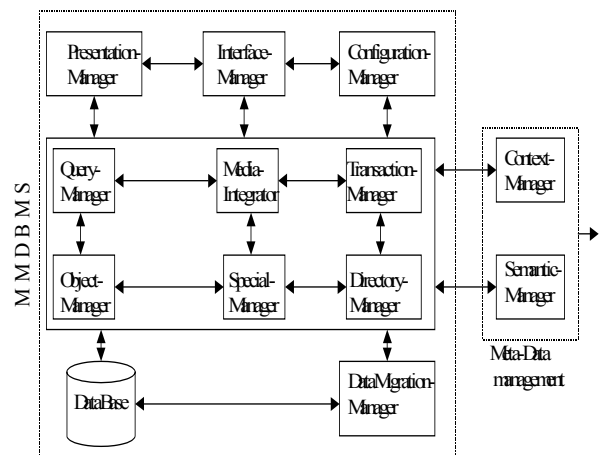
Computer use in the classroom has become a popular method of instruction for many technology educators. This may be due to the fact that software programs have advanced beyond the early days of drill and practice instruction. With the introduction of the graphical user interface, increased processing speed, and affordability, computer use in education has finally come of age. Software designers are now able to design multidimensional educational programs that include high quality graphics, stereo sound, and real time interaction (Bilan, 1992). One area of noticeable improvement is computer simulations. Computer simulations are software programs that either replicate or mimic real world phenomena. If implemented correctly, computer simulations can help students learn about technological events and processes that may otherwise be unattainable due to cost, feasibility, or

safety.

All the research on multimedia application in education can be divided in two groups: the research of efficient software or the research of efficient methodology. So much of the research on multimedia application in education didn't take into account that education systems must be flexible and easy to adapt to new, changing user requirements. So most of the more sophisticated, inventive pieces of instructional software deal with only a narrow slice of curriculum or with fairly trivial material. An efficient methodology must consider the social condition and the flexibility of education.

3.2 PROPOSED ARCHITECTURE OF MULTIMEDIA FOR EDUCATION ENGINEERING

One of the key problems in developing educational software systems in general and interactive instructional visualizations in particular is spelling for change [18,19,20]. This allows the education system the flexibility and the facility to adapt to new, changing user requirements. The state-of-the-art way of dealing with open requirements is to build systems out reusable components conforming to a plug-in architecture [21, 22, 23]. We can then change or extend the functionality of such systems by substituting or plugging in new components through the MMDBMS (see figure 1.1).



Fig(1.1): Architecture of MultiMedia DataBase Management System (MMDBMS)

Figure (1.1) represents the architecture of the MMDBMS. The main important things in the scheme are: first, the acquisition of the Data which results from the parfait adequacy between the subject of education and the responsibility of education. Second, the management of the Meta-Data, which has descriptive information about resources for the purpose of finding, managing and using then more effectively. The option of using the dynamic metadata has been proposed, so the teachers can convert a developed algorithm into a series of animation sequences by mapping algorithm variables, specifying animation actions, and associating execution points in the algorithmic chain to perform the

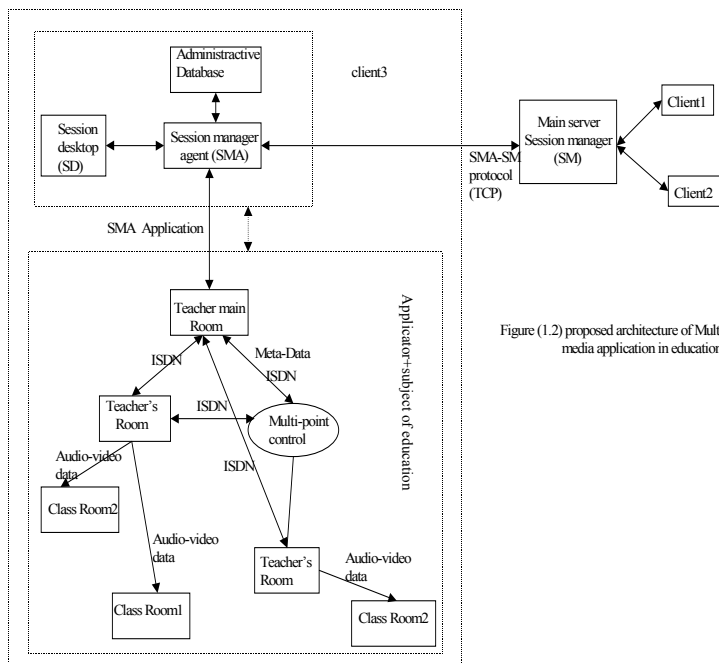


Figure (1.2) proposed architecture of Multi-media application in education

desired animation. Therefore, the teachers become designers of the visualization, they can customize the learning object to visualize a desired behavior that's appropriate for the course they are teaching. Thus, they use and reuse already developed instructional objects accompanied with dynamic metadata. Components can be as large as whole applications such as a PDF viewer. The visualization of JPEG or MPEG serves as a good example [16,18]. And the third a parfait correlation must exist between all the elements of the MMDBMS.

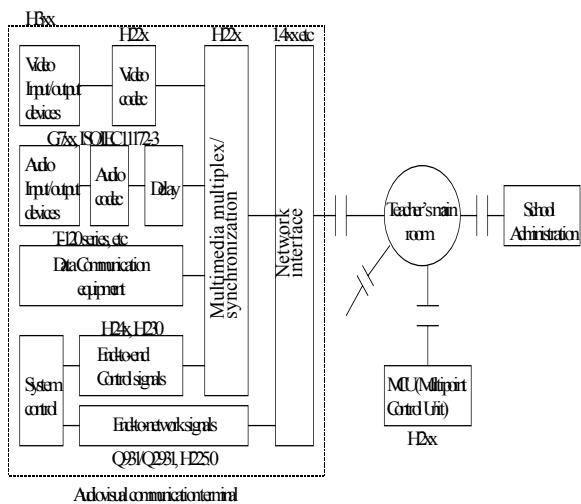


Figure (1.3) generic configuration of Audiovisual data for Multimedia communication

The figure (1.2) shows our proposed scheme of education with the Virtual Workspace architecture, which is based on a client-server model where the client machines are connected to servers to start or joint in cooperative sessions. Most of the virtual Workspace modules run over client machines through: the session manager agent (SMA) in charge of a session. and the session desktop (SD) which is the user interface to the administrative database that stores information about registered users. Only the server must run the session manager

(SM), a module responsible for the global coordination of sessions.

The session manager can be distributed between several physical machines, allowing multi-site cooperative sessions. Within an internal network an advanced high-quality tele-education services has been proposed using Integrated Services Digital Network (ISDN) for exterior sites in a point-to-point setup for the audio-visual data transmission.

The audio-video data configuration has been adopted (figure 1.3)

It consists of terminals, a network, and one or more multipoint control units (MCU). An MCU is connected to three or more terminals and allows multipoint communication among them. The guiding principle for these system standard developments is to allow as much inter-working as possible among different types of terminal. The use of common audio, video, and data coding methods has been sought with an individual communication system: communication control protocol is utilized in which two entities, such as terminal or MCU, can negotiate the capabilities they have and reach the best mode of operation. The system standard defines a minimum set of mandatory requirements for basic interoperability, but also allows the choice of optimal operation modes for enhanced functionality

4 CONCLUSION

In this paper, we define a methodology for multimedia in education. The advantage is that it integrates the available technologies but also guarantees a high quality final product. Teachers, educational leaders, educational policy-makers, and even parents are not only prospective audiences for education research but potential contributors to it. Education studies for a century have sought to illuminate and improve the scientific understanding of education, learning, and teaching. These other education stakeholders have a special insight into the day-to-day sites in which the theoretical knowledge and findings of educational inquiry could be applied; they also have the potential ability to tap new problems and solutions for long-standing concerns that should be shared with the educational research community.

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