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Cooperative Hypertext: An Educational Example

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ABSTRACT

The Internet is a good opportunity to modify the teaching methods and the process of learning, and to redefine our notions of education.

In this paper we present how to build a "Learning by Doing" environment using the Internet and the hypertext development. In our approach the role of the students is active inside their learning process. We refer of our experience how supervisor in a teaching project, named Web Learning Environment (WLE), where we have studied the use of the Internet and its resources to develop a new learning environment. We have involved a classroom (sixteen students, aged 16-17) of a technical institute in Italy (specialisation in Information Technologies). The project has been divided in six different phases: the knowledge of the Internet, the research in the Internet, the access to the FTP, the didactics with the Internet, the communication using the "Net", and the creation of a cooperative hypertext dedicated to the Bonaventura Cavalieri (an Italian mathematician). In this paper we describe some educational and cognitive aspects involved in the development of a cooperative hypertext (e.g., the work organisation, the educational and social targets, the interaction between students and teacher, the modification of the role of the teacher inside the students' learning process).

Keywords: Communication, Internet, web Learning, learning Process.

INTRODUCTION

The starting point of our research has been to consider that the computer technology is a fundamental part of education across the curriculum and will likely be more so in the future. In fact, the computers are becoming multimedia workstations for students. Innovative use of technology combines telecommunications (e-mail, online resources, Internet navigators), multimedia authoring (home page editors), user-friendly convenient applications software and are turns students into producers as well as consumers of content. Using the new media and the Internet in the educational process we have observed that the role of the classroom teacher is evolving from that of a giver of information to that of a facilitator of student learning [15]. The aim of our project, named Web Learning Environment (WLE), was to stimulate the active use of the Internet (and its technologies) in the educational process. For this reason the project has been divided in six different phases: the knowledge of the Internet (directly in the Web), the research of some educational information in the Internet, the access to the FTP (e.g. to download some interesting software tools to introduce in the educational process), the didactics with the Internet (using educational hypermedia online), the creation of a cooperative hypertext, and the communication using the "Net" [16].

In the WLE project the students were encouraged to work cooperatively in pairs while completing a WWW – based learning activity. In this paper we present the fifth phase of the WLE project dedicated to the development of a cooperative hypertext. This phase involved some interesting educational and social aspects.

HYPERTEXTS IN EDUCATIONAL PROCESS: AN OVERVIEW

Hypertext is described as non-sequential written text that allows branches and multiple paths to be selected by the reader. First idea of hypertext was presented by Vannervar Bush

as early as 1945. Bush proposed his MEMEX machine in an article entitled "As We May Think". The idea was to create a machine that would link or associate material for reference purposes [2].

"...wholly new forms of encyclopedias will appear, ready made with mesh of associative trails running through them, ready to be dropped into the memex and there amplified" [3]. Actually, the hypertext allows a reader to enter and exit at multiple points. For this reason the very nature of hypertext gives the reader the freedom to choose his or her own path. The evolution of the software and hardware technologies have permitted to the students to use the hypertext inside their educational process.

We can give the following characteristics which permits to the hypertext to become a learning tool:

- **Hypertext mimics the way the brains work;**
- **Hypertext supports the connection of ideas;**
- **Hypertext permits to choose a personal learning path.**

Hypertext is also considered by many researchers to facilitate the human learning [10, 13]. For example, in the most fundamental information –seeking stage of the human learning process, hypertext provides large integrated bodies of information in alternative representations for learners to browse through selectively. Using associative links and taking advantage of the structure of the information, learners are encouraged to explore and find the information they need, then progress to the learning activities [6].

COOPERATIVE HYPERTEXTS IN EDUCATIONAL PROCESS

The possibilities afforded by new technologies, combined with contemporary ideas about learning, have opened up new design opportunities for educational hypertext. In particular way, it is possible for the students to realise a cooperative hypertext on the educational subjects. Using this approach we can combine different learning strategies, for example the constructivist approach and the "Learning by Doing" environment. In agreement with these considerations, in the fifth stage of our WLE project the students have created a cooperative hypertext dedicated to Bonaventura Cavalieri (1598 - 1647) (an Italian mathematician) for an International Conference of Mathematics [17].

To realise the cooperative hypertext we have established these educational goals:

- **To drill the students in a cooperative project;**
- **To train the correct use of some software tools (e.g., Adobe PhotoshopÔ, GIF Construction Set ProfessionalÔ) and some hardware devices (e.g., the scanner, the sound cards) directly in a real project context (in agreement with a "Learning by Doing" approach);**
- **To learn about the mathematics in the seventeenth century;**
- **To understand the Cavalieri's indivisible theory;**
- **To analyse the connection between the mathematics and the physics in the seventeenth century.**

The first step of our project was to propose to the students an entry multiple-choice test to control their basic knowledge on the mathematical subjects involved in the hypertext (e.g., "Do you know the Cavalieri's indivisible theory?").
The statistical analyses of the entry test have demonstrated that the students didn't know this subject; in fact the percentage of correct answers has been 10% (13 correct answers on 128 answers). For this reason they were a reliable sample to study this "Learning by Doing" approach:

- **how to design and realise a hypertext (using the Internet as a big archive of information on the hypertext theory);**

- **the research of information on the HyperText Markup Language using some technical textbooks and journals;**
- **the bibliographical research of information on Bonaventura Cavalieri (using some traditional textbooks and the World Wide Web);**
- **the choice of information to insert in the hypertext;**
- **the hypertext's story board;**
- **the realisation of the user interface;**
- **the encoding of information in hypertext form;**
- **the control of hypertext (links, hot words, images, etc.).**

During the hypertext development, we have explained to the students to put a particular care to study the hypertext organization and to make the user interface "friendly". These aspects are important to avoid the Conklin's problem "lost in hyperspace" [7]. The graphic interface has been thought for an easy navigation; in fact, the navigation as a search for information still constitutes the bottleneck of most hypertext systems [4, 5, 9]. For these reasons, the students:

- **have organized a hierarchical hypertext;**
- **have chosen the icons, (e.g. a little home recalls the function which permits to go to the home page of the hypertext);**
- **have designed the visual interface, which involves the choice of colors, background, bottom shape, type and dimension of the fonts.**
  Sixteen students, organised in eight work groups, have developed these topisc: "Cavalieri's biography"; "Cavalieri: the religious figure", "Cavalieri's scientific production", "Cavalieri and the town of Verbania", "Bibliography", and "Other sites on Cavalieri" (with some links to other Internet sites).

Figure: 1 illustrates the hypertext's home page, we can note the simple interface (easy to learn).

The hypertext has been carried out using the Hypertext Mark Up Language because:

- **it is easy to learn;**
- **it can be integrated with applet Java and Java Script;**
- **it is independent from the runtime modules;**
- **it is independent from the s/w-h/w platform**

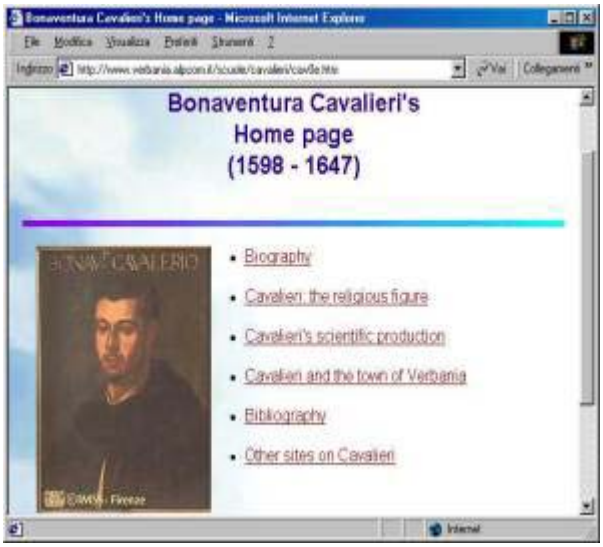

Figure: 1 The hypertext's home page.

The hypertext has been written in two languages: Italian and English, and it is available at the Internet address: http://www.verbania.alpcom.it/scuole/cavalieri/cav0e.htm

This project is an example of "Learning By Doing" environment because the students have learnt the history of mathematics during the hypertext development, and they have trained themselves to the use of software tools and hardware devices. The most obvious implications for the use of cooperative learning in the technology classroom would be that it would certainly aid students in their abilities to use the technology. Students could share knowledge, even as they construct their own knowledge. Many researchers have shown that cooperative learning is an effective method for increasing student achievement and motivation in the classroom [12, 18].

It is important to remember however that the teacher must be a facilitator in this cooperative learning environment, and not to fall into the trap of letting students totally "construct" their knowledge on their own. The teacher is still a very important resource and the computer is also a resource that will be used to help students in the acquisition of knowledge. To evaluate our students' knowledge we have proposed a multiple choice test (some questions are the same of the entry test); 85% of the students have achieved the educational goals that we have established (which corresponds to the 109 correct answers on 128 questions),

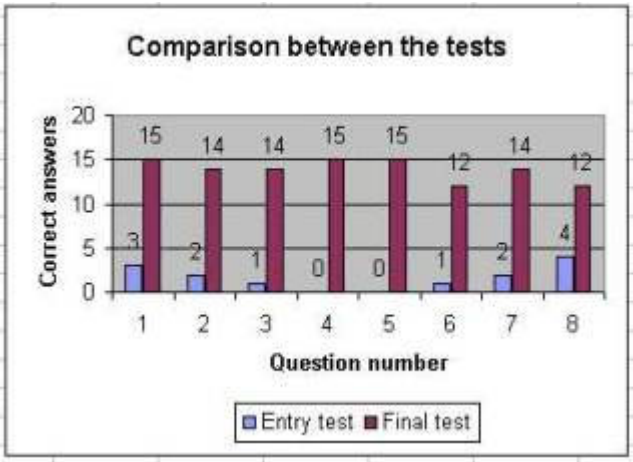

Figure: 2 illustrates the histograms of the comparison between the same questions in the entry test and in the final.

Figure: 2 Comparison between the entry and the final test. Observing Figure 2 we can note that the students have reached the educational goals on mathematics which we have established.

CONCLUSION

This project demonstrates that the new technologies and the Internet offer significant benefits in educational process, and it shows that there are clear educational advantages to be derived from cooperative student activities.

We can observe that traditional education is based upon a paradigm normally called the "knowledge reproduction model". This model depends on verbal lecture, printed handouts, drill and practice sessions, structured classroom activities. In its pure form this model is grounded in the belief that knowledge is objective and the purpose of the teaching process is to transfer this static body of knowledge from its source (teacher, textbook, etc.) to the student [11]. The student in this paradigm is viewed as a passive learner "waiting to be filled" with knowledge. Knowledge is not static, there are multiple sources of knowledge,

and students should not be passive learners. Students should be active in the learning process [14].

It is important to remember however that the teacher must be a facilitator in this cooperative learning environment, and not to fall into the trap of letting students totally "construct" their knowledge on their own. The teacher is still a very important resource and the computer is also a resource that will be used to help students in the acquisition of knowledge. The teachers need to be properly inserviced on cooperative learning theories and methods.

In addition, Jonassen (1994), states that collaborative learning environments support "collaborative construction of knowledge through social negotiation, not competition among learners for recognition." Research frequently shows that there are clear educational advantages to be derived from collaborative student activities [8, 19]. When students work in groups and small teams, the interaction s and activities frequently involve higher order and reflective thinking. Collaboration helps individuals to progress through their zone of proximal development through the communication and the joint activity in which they are engaged [20].

The use of new technologies to support engaged learning goes hand in hand with the philosophy of constructivism. Brooks and Brooks [1] present five principles of constructivism:

- **problems must be relevant to students,**
- **curriculum should be structured around primary concepts,**
- **teachers should seek to understand and value students' point of view,**
- **teachers should adapt curriculum to address students' suppositions,**
- **authentic assessment should be used as a tool to serve the learner rather than strictly as an accountability device.**

There are a number of implications for teachers in a constructivist approach with respect to cooperative learning and technology. First of all, the teacher is a guide, not the lead, as students construct their own knowledge. In addition, due to various backgrounds, not all students will understand everything in the same way. The teacher, therefore, through cooperative learning, can have them engage in activities which will allow them to understand their own thought processes and those of their peers, just by giving them a chance to voice them in group settings.

Inside our WLE project, the role of the teacher is evolving, in fact he is not only a giver of information but he is now a facilitator of student learning. We have noted that the students exhibited strong motivation in this hypertext development, and this is encouraging for the future application of this approach in the educational process. Our approach is in agreement with Papert's viewpoint: "Better learning will not come from finding better ways for the teacher to instruct but from giving the learner better opportunities to construct" [14, p.3]. This is only an attempt to realise an educational environment where the Internet and the hypertexts play an important role.

Editor's Note:

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