The application of hypermedia and WWW resources in the teaching and learning process at UNESP - Presidente Prudente campus

Arlete Meneguette, PhD
Faculty of Sciences and Technology
Department of Cartography
São Paulo State University
Presidente Prudente, SP 19060900, Brasil

ABSTRACT

The Cartographic Engineering Course is offered at UNESP - Presidente Prudente campus since 1977. In the last two decades many technological changes have occurred and its impact on the Cartographic Sciences have been felt. These innovations also caused a very strong impact on Cartographic Education and a change of paradigms has to be dealt with. Internet, WWW, CD-ROM titles, virtual reality are all part of the undergraduate course in Cartographic Engineering which employs those resources in the teaching and learning process. A prototype of a Courseware in Cartographic Sciences is available at the author´s home page (http://www.prudente.unesp.br/dcartog/arlete/hp_arlete/outros/index.htm) which also includes electronic portfolios developed by this author´s students. Portfolios are becoming very interesting and useful tools for negotiating meanings and carrying out assessment. This paper aims at presenting the application of state-of-art resources in Cartographic Engineering Education.

2. INTRODUCTION

Nowadays, new technologies are been employed everywhere and the network generation is getting used to terminology such as web sites, chat, links, ftp, irc, icq, which may mean nothing to their parents and even teachers. Schools and colleges have to take into account new challenges and play a very important role on the scenario. Educators need to be re-educated and a re-engineering process has to be dealt with within the field of teaching and learning, both at classroom environment and at administrative level.

In order to face such new challenges, this author has been adopting alternative strategies in the last ten years (1988-1998) involving Cartographic Engineering students at São Paulo State University (UNESP) - Presidente Prudente campus. In the beginning of the implementation process back in 1988 the students looked very insecure and surprised since the adoption of a social constructionist approach seemed to them to be more appropriate for first-grade students and not for college students. As time passed by new generations of students realised the importance and relevance of a problem-solving approach which takes into account the cognitive development steps of the learners, adopts iterative assessment strategies and allows students to take part in the whole process as active partners responsible for their learning in which the lecturer is a moderator as well as a learner.

The problem solving approach started to be employed with the simulation of the existence of a junior consulting company where this author played the role of a manager, the students where the consultants and a first client was selected: the Director of the University Campus. The problem to be solved was the lack of information for the general public concerning the University Campus (maps, folders, sign panels). Therefore a Project entitled "Visual Communication of UNESP - Presidente Prudente Campus" was carried out during which all the members took part, learning the theory and applying it to a real problem, evaluating all the stages of the process in which the client also participated. This project is still under development, each year a different team gives a new contribution and in the current year the results of this iniciative will be available through the Internet and multimedia kiosks.

A series of projects such as the one mentioned previously has been carried out under the supervision of this author, envolving students and other contributors (teachers and members of the community). The results obtained so far have been presented at events and published in order to disseminate both the new teaching and learning methodology and the practical results obtained by the consulting companies. It is important to mention that no money is involved in the activities, but the students learn how to apply for financial support, how to set up a plan of expenses within a time schedule, how to write reports and how to present the results generated through the educational experiment.

The results of this research indicated that the social constructionism can be adopted at the University level with success and that it may prove to be more effective than the conventional approach. In today´s world, when human resources are needed to solve problems imposed by the demands of the information sociey this author believes that a shift of educational

paradigm is required. But a few questions have to be answered:

- Are the lecturers aware of this new educational challenge ?
- How prepared are they to deal with information and communication technologies ?
- How technologically and digitally literate are third millenium engineers ?

Aiming at suggesting some alternative routes, this paper reports the pedagogical adventure carried out by this author who has been employing since 1995 a new media: the Internet. The readers of this paper are invited to take part in this trip and navigate off-line in the development stages of this educational research. Taking into account all the advantages of employing information and communication technologies this author has undertaken the development of Web Pages. The result can be seen at the URL: **Error! Bookmark not defined.**. At the moment the virtual visitors may have access to a few items:

- **Courseware** in Cartographic Sciences,
- **Virtual Visits** to Web Sites,
- **Chat Room** on Distance Education,
- **Electronic Portfolios**.

Another media is also been used, that is a CD-ROM, which is been produced employing an authoring software called Visual Class (**Error! Bookmark not defined.**, a very interesting tool for both teachers and students to use since it is user friendly.

3. WEB PAGES: DESIGN AND IMPLEMENTATION

In order to allow access to hypermedia teaching and learning resources, this author has developed a series of Web Pages, one of which is the Unesp – P. Prudente Campus Home Page. The virtual visitor may choose the "Departments" link, from which the Department of Cartography can be choosen, where there is a link to this author´s personal home page .As from the personal home page, the visitor may choose "Courseware", where there is a link to the hypermedia teaching and learning resources.

At the moment, the **Electronic Books** available cover subjects such as:

- Introduction to Cartographic Sciences
- Introduction to Mathematical Cartography
- Introduction to Geomatics
- Glossary of Technical Terms

There is also a special **hypertext** on "Reading Strategies" which gives suggestions on the use of skimming, scanning and comprehension techniques that can be used successfully by learners of all levels and ages.

Another option is the **OnLine Programme**, which will be available soon, allowing real time conversation including sound and live images.

One of the most important topics is the **OnLine Assessment** which includes: suggestion of practical activities to be carried out by the students along the process of knowledge construction, theoretical tests and lists of questions for further studies. Some of the questions were suggested by the students themselves, since they are stimulated to learn how to learn and therefore, they need to learn how to assess their own knowledge and that of their colleagues, applying peer review.

The preliminary notes are presented to the students so that they are aware of the steps to be followed:

- Access the hypermedia teaching and learning resources (Courseware)
- Answer the questions and carry out the activities suggested (OnLine Assessment)
- Send the answers to this author through the e-mail (**Error! Bookmark not defined.**)
- Take part in a chat at **Error! Bookmark not defined.** in a certain day and time

The list of questions for study follows after those comments.

Students are also invited to read papers in English so that they can improve their command of this international language. Special activities were also prepared by this author so that this can be accomplished.

At any time students may come across with technical terms which are unusual to them, but this author prepared a Glossary to give them a helping hand.

It is important to mention that a list of books is always included in order to allow students to carry out their own in-depth research

However, considering the speed of development, books may become out-dated very quickly, this is why a Comprehensive List of Links has also been included in the home page. As from the links, students may visit virtually some of the most important Universities and Research Centers which keep sites on the Web. The virtual visitor may also get some information about the intended site for visit before taking the trip.

While the OnLine Programme option is not yet ready, chats have been carried out since June, 12th, 1997, at **Error! Bookmark not defined.**, where this author acts as the manager of a virtual room devoted to Distance Education. Every week virtual meetings are conducted embracing students, lecturers, researchers from all over the place, who share their experiences, hopes, doubts and dreams of na integrated community

linked by the new technologies towards the rise of a new alternative: the creation of an Open and Distance Education Programme in Geomatics for Portuguese speaking countries.

In order to take part in the Chat it is necessary to know when the virtual meeting is going to happen and that information is given the "Schedule" option (Agenda).

All the students are motivated to share their experiences with others, therefore they have been developing their own home pages, which may be accessed from this author´s home page under the link **Electronic Portfolios**, as can be seen in the next section of this paper.

4. ELECTRONIC PORTFOLIOS

A very effective approach to be employed by University lecturers is the use of **portfolios**, that is a compilation of cultural artefacts gathered throughout the academic life. [3] suggests the use of portfolios containing: material prepared by the lecturer himself, material prepared by other contributors, excerpts from students´s portfolios and so on.

In their home page on Portfolio Assessment in Science [1] explain that:

"A portfolio is simply a collection of work with a purpose. It contains evidence of a person's knowledge or skill. Designing the portfolio involves deciding what the evidence is to establish and what counts as evidence. The portfolio developer actually collects and organizes the evidence into a portfolio. In some cases, the teacher will be the designer while the student is the developer; in other cases, the teacher and students may work together to design and develop the portfolio. An important part of a portfolio design is its purpose. There may be two kinds of purposes for the portfolio: goals and uses. The goal for the portfolio may be that the students will understand how chemistry is related to daily life, or that they have knowledge of particular science concepts. The use of the portfolio may be for grading or showing others what was learned. The purpose of the portfolio clarifies the objectives of the course and prevents the portfolio from becoming merely a collection of work. The purpose of the portfolio must be clearly communicated to the students. Evidence can be presented in many forms, including notes, homework, tests, finished papers, drafts, sketches, drawings, photographs, and video or audio recordings. There are four types of evidence: artifacts, reproductions, attestations, and productions. Artifacts are samples of work that a student does during the course, such as a test, a homework assignment, a paper, or a lab report. Like artifacts, reproductions deal with what a student typically does during the course, but the information they exhibit is usually not captured. For example, a video recording of a student's presentation and photographs of a DNA model could be classified as representations. Evidence is classified as an attestation when someone verifies the student's competence. This would include a written evaluation by the teacher or a letter from the science fair committee. Finally, productions are pieces that are prepared specifically for the portfolio. Goal statements, reflections, and captions are three kinds of productions. Goal statements communicate the purpose of the portfolio. Reflections can outline the contents of the portfolio and express how it demonstrates that its purpose has been accomplished. Captions help the portfolio assessor by explaining what each document is, what it is evidence of, and why it is valid as evidence. In addition, captions allow the students to express what they have learned and accomplished.

The portfolio designer must decide who will determine what evidence is valid and appropriate to include. The teacher might specify exactly what should be included in the portfolio, or allow the student to make all the decisions, or prescribe some evidence and leave some choice for the developer. Giving students some guidance as well as some freedom seems to work best. Generally, it is appropriate to give older students more freedom of choice. In Slater's physics course at Pittsburgh State University, the guidelines regarding what the students could include in their portfolios were few. The students placed anything they thought clearly demonstrated their mastery of each of the learning objectives into their portfolios. Each piece of evidence needed a statement of self-reflection that the students used to support how well they thought that they had mastered the learning objective and what was their process toward mastering the objective.

Although it is clearly unnecessary to include every possible document as evidence, it is not so clear how much evidence should be incorporated. The value-added principle states that evidence should no longer be included when it ceases to add anything to the portfolio. After it is decided that several pieces add nothing of significance, then the portfolio probably contains sufficient evidence.

The portfolio has many uses. It can be a motivator because it allows students to focus more on their interests in science. There is more autonomy for the student, and the student can build self-confidence because he is more in control of his own learning. The reflection process is important in the creation of a portfolio because it gives the student a greater awareness of the learning process. The students are required to assess themselves and their work. the portfolio highlights the accomplishments of a student rather than weaknesses, and also promotes creativity. A portfolio invites students to invent, organize, predict, represent, visualize, genuinely reflect on what they are learning, and build self-confidence.

The main disadvantage of portfolios is that it requires much time and effort from the teacher, especially if

there is a large number of students. Also, portfolios are difficult to compare and grade because of the diversity involved. For this reason, a clear system must be established for evaluating the portfolios. The portfolio allows teachers and students to evaluate science skills that may not be evident in grades because the information they contain may be more representative of a student's abilities. However, because it is difficult to compare and score portfolios, it might be best to use a combination of assessment methods, including both a portfolio and traditional forms such as tests. This would still allow students some control over their own learning, encourage students to evaluate themselves, and highlight their strengths. It would also reduce the burden of designing a portfolio that would cover all of the course objectives. In addition, because the portfolios would be smaller they would also be easier to review and grade.

Another alternative might be to make the portfolio optional. For example, a teacher might let the students choose to do a portfolio, a report, or a science project to fulfill a particular course objective. This would reduce the number of portfolios to review and help ensure that the students will get the most out of the portfolios because they are choosing to do them. Unless the portfolio developer and designer agree on the purpose of the portfolio, even the best-designed portfolio will fail to be effective.

Because portfolio assessment in science is still relatively new, teachers who choose to use portfolios have the challenging task of designing portfolios. Therefore, it might be best to start off small, with one class for a short time period, and for a limited number of objectives. Then, as teachers discover what works best, they can expand their use of portfolios as an effective tool for assessment in science."

However, the use of analogue portfolios may become very awkward as time passes by and the amount of material starts to impose some difficulties for handling and transporting.

That is why a new approach was adopted by this author: the development of electronic portfolios.

The advantages of the digital version of portfolios can be seen in the dialogue established through the electronic mail with Sean Ishii in March, 30th, 1998:

From: **Error! Bookmark not defined.**
To: Sean Ishii **Error! Bookmark not defined.**

> I have been working with electronic portfolios for some time and I am glad there are other researchers employing the same approach. After a few years using analogue portfolios with my undergraduate students at Sao Paulo State University I started a new activity: replace the conventional notebooks with electronic notebooks - I mean, using floppy disks instead of paper. At that time we just used word processors such as Word for Windows and other kinds of software for drawing and painting. That is what we called "Digital Literacy". Later on we started writing hypertexts using HTML and now we are also starting the use of VRML.

In his reply to this author, Sean Ishii explained that:

From: Sean Ishii **Error! Bookmark not defined.**
To: **Error! Bookmark not defined.**

> The use of electronic media can now shrink the need for passing around bulky portfolios. It can also make manipulating portfolios much easier. It becomes much easier to tailor the portfolio for whatever purpose, whether it is for assessment as in a classroom or for a job search.

The use of electronic portfolios in the teaching-learning-assessing process of Geomatics is detailed reported in [2]. This approach is been implemented continuously and readers are invited to visit this author´s home page where access is given to the student´s electronic portfolios containing a compilation of their academic lives. An OnLine Curriculum Vitae Database is also under construction and it will allow access to very relevant information concerning oportunities for training, jobs and follow-up studies.

5. FINAL REMARKS

This paper aimed at presenting some of the iniciatives undertaken at São Paulo State University (UNESP) – Presidente Prudente Campus, during the period of 1988-1998, in which new information and communication technologies have been employed in teaching and learning.

Innovative multimedia teaching tools are still under development but the main concern of this author is related to assessment – what is being done throughout the whole process by adopting many different strategies (self-evaluation, peer assessment, external assessment).

Another field dealt with is the Open and Distance Education for which mechanisms have been implemented and a beta-version is already working successfully.

Laboratory instruction has been integrated with theory through the development of practice-based engineering and problem-solving approaches whereas students simulate the existence of a junior consultancy company under the supervision of this author and try to solve real problems presented by a real client, adopting a total quality approach (PDCA).

This has required innovations both in curricular contents and structure, as well as the integration of

other disciplines and lecturers in a transdisciplinary view of the world.

The end of the 20th century is imposing a new challenge on the educators, mainly on those dealing with Engineering Education.

It is necessary to:

- learn how to learn,
- to think about the thinking,
- to re-engineer our disciplines so that Engineering may play its very important social role.

A new generation of engineers has to respond to the increasing demands of the post industrial technology-based globalised economy as well as to the requirements of the information society.

The time asks for:

- interoperactivity,
- interoperability,
- investigation,
- interactivity,
- integration,
- inspiration,
- instruction,
- insight,
- intuition,
- integrity,
- intelligence,
- involvement,
- interaction and
- international cooperation.

Let us give our contribution, day after day, thinking globally and acting locally.

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