



# Teaching Computer Programming in a Distance Learning Environment

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## ABSTRACT

This paper examines problems faced by tutors teaching computer programming in a distance-learning environment. After brief introductory remarks about some changes in the global learning environment, the paper introduces various techniques that can be used by faculty to create an effective learning environment for students and make the presentation of a programming course practical and interesting. Finally the paper discusses the role of the teacher in the light of the new technologies and the Internet.

## 1. INTRODUCTION

Lifelong learning has become an increasingly important need for many people and an intrinsic feature of the modern, knowledge-driven world. This leads to considerable demand for high quality distance education, which is one of the most flexible ways - and, in some cases, the only way - to deliver lifelong learning. The advantages of flexible distance learning are particularly attractive for adult students with full-time jobs and families, looking for the education necessary for their careers. With distance learning, they can receive an academic

qualification while still carrying on their daily duties. Most students at The Open Polytechnic of New Zealand, enrolled in the degree or diploma level courses in Information Technology, belong to this category, though some students study simply because of their 'internal' need for self-improvement.

This paper discusses some of the teaching techniques used at The Open Polytechnic to teach a computer programming course and the role these techniques play in creating an effective learning environment. The role of the teacher is also discussed.

## 2. NEW PROGRAMMING COURSE AND TEACHING TOOLS

The course 'Programming with Visual Basic' was first offered in The Open Polytechnic of New Zealand in February 2001 and is offered in two semesters each year. Although this is an introductory programming course, it is quite intense and contains some more advanced programming concepts and techniques. The course consists of printed learning material (Learning Guide) and a textbook, but much of the learning process occurs online. This includes teacher-student and student-student interaction, student support, assessment submissions and feedback. All course assessments are submitted through The Open Polytechnic's Online Campus web site.



All students are subscribed to the course mailing list. We use 'Majordomo' as a mailing list management program. This program handles routine administration tasks automatically, and reduces the workload of the teacher.

The structure of the printed Learning Guide accommodates a teacher-directed approach - a predefined sequence of topics, programming exercises and activities organised on a week-by-week basis. We believe that this approach is justified, considering the introductory level of the course and the nature of the subject, which demands a carefully defined, logical order of topics to study.

It is essential that a course in computer programming employs a problem-based learning approach; for that reason a large number of programming exercises and projects were included. The content of many of these programming tasks reflect real-world situations.

Part of these programming activities consists of regular and frequent programming projects. We consider these regular projects as an essential part of the course. When the course was first offered it was difficult for the teacher to cope with almost a hundred student projects coming in on a weekly basis to be assessed. To reduce the teacher's workload in the next semester, we introduced a practice of posting sample solutions to the weekly projects on the course mailing list. The solutions were sent out on the day following the due date for a particular project. This eliminated the need to provide individual feedback for every student, but general feedback highlighting the common errors, was posted to the mailing list. The regular programming projects helped to maintain a good pace of studying, and also helped the teacher to be aware of a student's misunderstanding of the particular topic in a timely fashion and to provide prompt feedback.

### 3. CREATING AN EFFECTIVE LEARNING ENVIRONMENT

Though the teacher is physically separated from the distance learners, the major pedagogical principles are still in place. Students need support, feedback, and motivation. Students need ways of expressing themselves; not only their thoughts, but emotions as well. Students need to explain how they understand a particular programming aspect and how

they approach the given task. They need also confirmation that their understanding is correct.

To develop an effective learning environment for our students we tried to ensure that the main pedagogical principles underlying high quality education were fulfilled. We believe that a very important pedagogical aspect in distance learning is human interaction. It is good to have a well-designed Learning Guide and a first-class textbook, but this is not enough. Learning also requires interaction, both teacher-student and student-student. We consider this interaction as the main contributor to the active learning and development of critical thinking in our students and aimed to keep this interaction at the highest possible level.

#### 3.1 TEACHER - STUDENT INTERACTION

The interaction between teacher and students in our course has been mostly maintained through the email and telephone dialog. Email conversations with our students proved to be very useful and fruitful. In this mode (as opposed to face-to-face dialogs), students have more time to carefully formulate their questions; which is advantageous to both teacher and student. Teacher-student contacts were also helpful in motivating students to continue working, when they had family or work related circumstances.

One very important component of teacher-student interaction was communication via the course mailing list. The mailing list was used by the teacher for several different purposes:

- ◆ providing instructions, tips, and advice on the current topic
- ◆ answering commonly asked questions
- ◆ providing links to relevant web sites
- ◆ sending discussion questions to the list
- ◆ providing sample answers to programming exercises and projects
- ◆ stimulating and encouraging students
- ◆ sending comments on assessments.

The teacher's feedback included answers to ad-hoc students questions, sample answers to programming exercises and weekly programming projects, and comments on in-course summative assessments.

## 3.2 STUDENT - STUDENT INTERACTION

We encouraged students to introduce themselves on the mailing list at the beginning of semester. Students willingly did that, describing their biography, family, goals in life and study, hobbies etc. This helped to create a community of learners.

The interaction between students occurred through the asynchronous electronic mailing list discussions. This mode of Internet-based discussion, proved to be really effective, as students had a chance to think carefully about the discussed issue. It is hard not to overstress the importance of email discussions - sometimes inspired by the teacher, sometimes spontaneous - in grasping the core programming concepts and clarifying poorly understood details, as well as in stimulating and motivating students.

The interaction between students also took place when students answered questions raised on the mailing list by other students. In this case, the teacher did not rush to answer the question himself, but allowed discussion and debate to develop, giving students a chance to answer the question. This was favourable to both parties - some students learned from others, while the others felt themselves more confident in the newly acquired knowledge, as well as satisfied with helping others.

There are some components of the human communication that are missing in online communication; such things as voice modulation, body language, etc. are also valuable. Students usually try using special techniques, such as 'emoticons', to compensate these lacking interaction components and express their emotions. The teacher can help students to familiarise themselves with these and other Netiquette rules and techniques.

## 3.3 STUDENT JOURNAL

Learning is not a passive process, especially when the subject of learning is computer programming. To make the learning active, discussions on the mailing list were a key tool. Another tool employed to facilitate active learning was the student journal. Students used the course journal as a workbook to record their responses to activities and specific questions about the course content, and, most importantly, to record their reflections on the learning process. It was explained to students that the student journal is a very good tool in understanding how they learn. Students

reflect not only on what they have learned, but on their approach to learning - was it effective or not, are there better ways of studying? Students were advised to reflect on problems, difficulties they met and the ways they resolved these problems.

Using this technique of reflecting on a given question or problem is actually an implementation of a constructivist approach to learning (Morphew, 2000), where students are forced to reach back into their prior learning to co-construct the meaning of the new learning.

Both tools - mailing list discussions and the course journal - proved to be successful in achieving their goal and we had very positive student feedback on that.

## 4. ONLINE DELIVERY

Today, information technology offers the ability to directly deliver learning to a wide range of population. Online courses that employ multimedia technologies can provide a high level of interactivity, and online learning activities can serve as a valuable tool for teaching. The course web page can contain much of the learning material, such as the text, images, diagrams, animations, audio and video clips, and so on.

We will continue to explore this new medium for teaching computer programming. It is planned to offer this programming course through Open Mind Online - the Internet delivery arm of The Open Polytechnic of New Zealand.

## 5. THE TEACHER SUPPORT

The new teaching and learning environment, currently unfolding, is set to change the traditional roles of student and teacher. The role of teacher will not only be that of subject expert, but also of facilitator, managing the transformation of information into knowledge. Furthermore, in light of the speed of progress, the teacher himself will be cast as learner, continuously updating his or her knowledge base and enabling students to do so as well. Information will be increasingly available from sources other than the teacher, and a new emphasis will be placed on leadership and motivational skills. The Internet is just a medium, and there is plenty of room to develop different student support services and to make the most of available technologies while relying on the

teacher's dedication and ability as the most important educational tool. As competence in teaching is gained through experience, the new roles of the teacher will require strong infrastructural support within the teaching institution for risk-taking and reflection.

Another change in the role of the teacher occurs in the light of implementing-Internet based learning strategies. Noble (1998) sees the new technology drawing teachers into a production process where they become subject to "all the pressures that have befallen production workers in other industries undergoing rapid technological transformation from above", and draws attention to the ethical issues involved in intellectual ownership and appropriate use of online materials.

## 6. CONCLUSION

Distance teaching is able to provide a high standard of student support and achieve very good results in creating an effective learning environment. The availability of the Internet and other modern tools makes it possible to support distance education students in a way that can put them on equal footing with campus based students. As a result, a wider range of people can receive high quality education and a high level of satisfaction with their educational experience.

Creating an effective learning environment is essential in teaching computer programming at a distance. The main techniques for creating and maintaining a high level of interactivity between teacher and students, and between students, and also making the learning process active, include electronic mailing list discussions and a student journal.

## REFERENCES

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