

# **AN ANALYSIS OF A WEB FORUM IN DISTANCE AND FACE TO FACE TEACHING OF A FIRST YEAR MATHEMATICS SUBJECT**

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## **ABSTRACT**

Almost all of the subjects taught at Charles Sturt University (CSU) are supported with electronic communications. The electronic communication facilities provide students with communication tools such as direct e-mail to the subject lecturer and a subject web forum to enhance student-student-lecturer communication and, hence, learning.

In this paper, we discuss the benefits of a subject web forum for both external and internal students. In addition we present the results from a questionnaire designed to discover the perceptions of students regarding their experience with a first year mathematics web forum. The usage statistics of the subject web forum are also presented. Web forums provide the opportunity to establish a frequently asked questions (FAQ) database for first year mathematics subjects. Questions posted by students over recent years can be examined and accumulated into a FAQ database.

We will also discuss the infrastructure and human resources needed to develop such a subject web forum in Atilim University, Turkey and to make this forum available to other universities through Turkish Higher Education Council (YOK). In the Turkish distance education system, subjects (including mathematics) have enrolment numbers in the order of thousands. The web forum discussed in this paper may be a cost effective and enhanced alternative for deliver of subjects with large number of enrolments in distance mode.

# 1. Introduction

In any teaching environment it is essential for us as educators to be constantly aware of the need to match what we are teaching with whom we are teaching. As academics we must recognise the need to vary our approach and style as our learners at tertiary institutions could be school leavers, mature age students, on campus or distance education students. For example, the nature of teaching a course that is offered purely by distance education requires alternate approaches to fulfil the basics of face-to-face teaching such as student/instructor interaction. Distance education technologies are expanding at rapid rate to make distance education a viable option for many tertiary institutions. The Internet has proved to be a valuable tool for enhancing the effectiveness of distance education.

Almost all of the subjects taught at Charles Sturt University (CSU), Australia are supported with electronic communications. The electronic communication facilities provide students with communication tools such as direct e-mail to the subject lecturer and a subject web forum to enhance student-student-lecturer communication and, hence, learning. A subject web forum is implemented to support external and internal students as well as students from partner institutions of CSU. Most of these partner institutions are from overseas countries such as Malaysia, Canada and England. All students enrolled in a subject delivered in distance mode receive some materials that explain how to use on-line facilities of the subject as well as other on-line facilities available at CSU. It should be pointed out here that a web forum for a subject is an additional facility to the printed material supplied to every student.

The issue of equity is one of the hurdles on-line teaching needs to overcome since not all students have on-line capabilities. Students cannot be required to access the web and use its resources unless the requirement is a university policy. Starting 2002 the communication between the CSU administration and all students enrolled in distance mode is in electronic form. Hence, every student enrolled in CSU courses is expected to have access to an electronic communication medium. For the equity principal, CSU provides dial-up modem facilities to facilitate access to the University network.

The web forums allow for open discussion, at the convenience of the students. The subject web forum is available to all students (distance and internal) enrolled in the subject and the subject lecturer to enhance their learning/teaching. The advantage of employing a subject web forum to enhance traditional distance education is that it alleviates some of the problems encountered by distance education students that internal students do not normally face (Meyenn et.al., 1996). Some of these problems are:

- absence of face to face contact;
- isolation of students;
- reluctance of students to contact instructors;
- feeling of not belonging or being part of the university;
- absence of collegiate atmosphere;
- late delivery of mail packages;
- inadequate feedback from instructors.

A carefully designed and managed web forum provides an effective tool to eliminate or alleviate some of the above problems. For example, students can access a web forum to generate a collegiate atmosphere with their fellow students. In fact, the most popular and most used feature of web sites is the communicating section for a number of subjects (Wood, 1998). In a typical subject

such as a first year Mathematics subject, a lecturer at CSU may spend about two hours per week communications with his students via various on-line tools, mostly on the subject web forum. This is comparable with a tutorial component of a typical face to face teaching of a subject.

This paper is organized as follows: In section 2 we present survey results from distance as well as internal students to reflect their perceptions regarding their experience with a first year mathematics web forum. In section 3 we discuss some technical difficulties in running a mathematics web forum as well as the opportunities presented by a web forum such as establishing a frequently asked questions (FAQ) database for first year mathematics subjects. The usage statistics of the first year mathematics subject web forum will also be presented. In section 4 we discuss the infrastructure and human resources needed to develop such a subject web forum in Atilim University, Turkey and to make this forum available to other universities through Turkish Higher Education Council (YOK).

## **2. Web Forum: Student Perception**

We have been interested in using technology/Internet in teaching our mathematics subjects at CSU since 1996. We first had the opportunity to participate in a multi-variable calculus subject in the distance education mode offered by the Harvard Extension School. This subject was completely taught with the software package Mathematica (Mathematica, 2002) based on the Calculus and Mathematica (C&M) notebooks (See the reference: Calculus and Mathematica, 2002). Jerry Uhl and Horacio Porta originally started the C&M program at University of Illinois, USA. The C & M notebooks are designed to make students think about mathematics in terms of objects that they can see, and operations upon those objects. Visualisation is also an important part of C & M notebooks. Our experience from this project was presented at the SUTMEG conference (Altas et.al., 1996).

Following this experiment we introduced the software package Maple as a symbolic calculation package in face-to-face teaching of the first year mathematics subjects in 1997 (Maple, 2002). The main reason on the choice of the software package Maple was its intuitive syntax and the familiarity of the teaching staff with Maple from their research projects. We believe that using a symbolic package in teaching has had a positive impact on student learning. A student survey revealed that 85% percent of students enjoyed the Maple component of the subject.

As educators we need to develop techniques to balance distance teaching and face-to-face teaching methods. In the past, teaching mathematics by both internal and external modes has caused problems in the presentation of dynamic mathematical concepts, to both groups of learners. The new computing technologies such as hypermedia and www, in conjunction with the use of self-instruction learning methods (for example, C&M mentioned above) and mathematical computer software in mathematics teaching alleviated any imbalance with dynamic teaching methods in both modes of teaching. A subject forum is a powerful and easy use interface to bring together such teaching tools.

In 2001 there were about 46 internal and 35 distance education students studying the first semester calculus subject. These students were mainly from the information technology and science degree courses. A student survey was undertaken at the end of the semester to understand the students' perception of the subject forum. A majority of distance education students, about 86%, used the subject forum and found it useful in their learning. However, the ratio of internal students not using the subject forum was about 54%. This was considerably higher than we expected. Further analysis of this group of internal students revealed that more than half of them,

about 64%, did not need to use the subject web forum as an extra tool to enhance their learning. They found Maple laboratory sessions; tutorials and lectures were sufficient for their learning. Regarding the remaining 36% of this group of internal students we believe that two factors contributed to not using the subject forum and hence, not to make use of another learning tool to enhance their learning:

- i) Some of them may not be comfortable using computers, especially environmental science degree students;
- ii) Although on-campus students were provided with the distance education learning materials, in which the subject forums were explained, they may have had problems adjusting to the new environment in their first semester.

We will be closely monitoring this issue during the next teaching session in 2002.

In the survey, students were also asked to state an aspect of the subject forum they found most beneficial. The majority of the answers can be grouped under seven headings with their respective percentages as in the following table 2.1

<b>Answers</b>	<b>Percentage</b>
Group interactions and contacts	26%
Help provided to complete my assessments	19%
Ability to discuss problems with others	17%
Read questions/answers posted by others	16%
Motivation	6%
Seeing on the forum that other people are having problems as well	6%
Others	10%

**Table 2.1** Some beneficial features of the subject forum identified by the students

### **3. Techniques, Usage Statistics and Opportunities**

The e-learning environment at CSU has been developed in-house and is implemented as a standard template for all subjects offered by the University. This standardisation has significant advantages in that all students become familiar with the CSU e-learning environment and this basic environment does not change between subjects. Common features available within the e-learning environment at CSU are; subject outline & assessment information, access to on-line teaching resources, including electronic print materials, on-line submission of assignments, e-mail access to the teaching staff and other students as well as an on-line forum. While most of these features are also available in commercial e-learning packages such as Blackboard and WebCT, CSU has chosen to develop its own in-house e-learning software environment. Major reasons behind the decision to develop in-house software were the large scale of the distance education operation at CSU together with the advantages of easier internal customisation and integration with other CSU student record systems.

One of the disadvantages of this common learning environment is that the development of e-learning tools such as the subject forums has initially catered only for simple text based discussion. Clearly this environment severely limits the scope for technical discussions that require mathematical notation or diagrams. Subsequent forum development now allows for attachments to be included with the forum text message, however effective technical communication is still limited.

While attachments open the possibility for staff and students to exchange technical information in various commercial file formats such as Microsoft Word & Equation Editor, LaTeX, Maple7 and Mathematica, the cost and non-adoption of these packages by distance students pose severe problems with distributing mathematical information in these formats. After trialing many alternatives one of the most effective formats for distributing technical information to students was found to be the Adobe Portable Document Format (PDF). The PDF reader is free and readily available to students over the web and output from almost all computer packages, including those listed above, can be captured through the Microsoft Windows PDF printer driver that comes bundled with Adobe Acrobat. In addition, handwritten mathematics can be scanned and saved in either PDF format or distributed as a GIF file that can be viewed by almost any web browser.

The option of purchasing a cheap scanner, less than AU\$100, and exchanging handwritten mathematics as scanned graphics files is also recommended to our students. This solution opens the opportunity for students to submit simple handwritten mathematical enquires and for the lecturer or student respondent to print the correspondence, add their own handwritten reply, scan and return. However to date most distance students have elected to simply pose their mathematical questions and replies in a simple Maple-like mark-up style such as  $\int(x^2 + \sqrt{x})$ ,  $x$ ). The use of scanned handwritten mathematics does however considerably ease the time constraints on lecturing staff who often need to respond to numerous student forum enquires.

Over recent years there has been a significant growth in the use of subject forums by CSU students. The number of posts to forums increased from 1,000 in March 1998 to over 17,000 in March 2001, a 1,600% increase. It is interesting to note however that many more students visit and view the forums without posting, the ratio of views to posts being 20:1. This behaviour appears to parallel the experience in on-campus lectures and tutorials, where passive students are reluctant to pose active questions but are content to simply listen to the discussion going on about them. One of the major challenges facing forum administrators is to try and generate a forum environment that encourages more forum members to become active participants.

A significant opportunity associated with the growing use of subject forums is the possibility of establishing a database of frequently asked questions. As in traditional tutorial classes, there are many student questions that re-occur on a frequent basis. The electronic nature of forum enquires and associated responses opens the possibility of easily collecting this information into an FAQ database. The establishment of this database should not only ease the forum response demands on academic staff, but should also help provide more timely assistance to students with commonly occurring help requests. Analysis of the nature of specific questions entering the FAQ database should also provide valuable feed back to teaching staff on the effectiveness of the teaching program and curricula.

#### **4. A Framework for Atilim University, Turkey**

Atilim University, a private institution founded by Atilim foundation (1997), is located in Ankara, Turkey. Current enrolment is about 1100 in the faculties of Engineering, Arts and Science, and Management.

The mathematics department of the Faculty of Arts and Science offers mathematics subjects to all three. Among these calculus subjects is a 2-semester course offered to about 250 students of the Faculty of Engineering. This course has 6 contact hours/week. Four hours are allocated to the theory and the remaining two for the tutorials and computer laboratory work.

During the laboratory session students get a chance to familiarise themselves with a symbolic mathematics tool such as Mathematica, and perform pre-designated calculus projects under the supervision of the course instructors. This enhances the student's ability to comprehend the theory discussed in the lectures and gives them a chance to verify their solutions to problems.

Atilim University has plans to enhance education by incorporating web technology into the curriculum starting with calculus and computer literacy courses. Obviously, in calculus subjects student-lecturer interaction and access to the lecturer outside the lecture hours are crucial.

The concept of Virtual Classrooms and Virtual Office Hours (VOH) via the Internet can be easily established by utilising an asynchronous tool such as e-mail or discussion lists. Whenever possible, voice can be integrated into VOH using for example, Microsoft's NetMeeting tool (See the reference: VOH) for synchronous communication.

An alternative option that will be taken by Atilim University is to set up web-based calculus subject forum to complement face-to-face education by taking the CSU model as a basis. This will incorporate the following features:

- on-line course material (lecture notes, problem sets, solution sets, etc.)
- on-line exams
- access to Mathematica
- e-mail

The subject web forum will offer the students the possibility of formulating and submitting their questions into the forum and will involve the classmates and the instructor.

To achieve this objective Atilim needs a new technology centre, and faculty training. Faculty training should start at an earlier stage of the project. An information technology support officer has been already employed for this purpose. Instructor involvement in the design phase is crucial to the overall success of the on-line learning program. We plan the involvement of instructors in the design phase of our web-based learning project. Some of the required prerequisites for a successful execution of the program are listed below:

1. The establishment of a Centre for Educational Technology (CET);
  - to take an initiative in improving the existing infrastructure for web based distance education;
  - to inquire, manage, and update the technology required;
  - to train supporting staff (facilitators/assistants);
  - to help in the design of web material/documentation;
  - to allocate resources .
2. To design new diploma programs in the existing vocational school to support CET to train/educate
  - web masters, web designers/developers;
  - technical staff for telecommunications/networking.
3. In addition to the existing computing facility, new computer multi-media laboratories for easy access to facilities provided by the web courses from within the campus.
4. Appointment of instructional designers to help lecturers in the preparation of distance education materials.

We believe that having a database formed with frequently asked questions based on the questions raised in a maths subject web forum will be a useful tool in delivering the subjects to classes with a large number of students. This approach may be a cost effective and enhanced

alternative to the delivery of subjects with large number of enrolments in distance mode. However, a distributed farm of web servers should have been established in several cities to handle large number of student accesses.

## 5. Conclusions

We believe that web forums provide an opportunity to establish a frequently asked questions (FAQ) database for first year mathematics subjects. This will be a valuable resource for students to enhance their learning and for lecturers to deliver their subjects efficiently.

Our analysis indicates that majority of distance education students are benefiting from web forums in a number of ways such as; group interaction with their fellow students and reading questions/answers posted with other students. This is also supported by the usage statistics of web forums. The number of posts to forums increased from 1,000 in March 1998 to over 17,000 in March 2001, a 1,600% increase at CSU. It is also interesting to note that many more students visit and view the forums without posting, the ratio of views to posts being 20:1.

Initial analysis with Atilim University indicates that using web forums may help developing countries to deliver their teaching efficiently and effectively, especially for subjects with large number of enrolments.

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