THE INTERNET AS AN EDUCATIONAL TOOL FOR EFFECTIVELY UNDERSTANDING THE ENGINEERING PROFESSION

Dr Kasim Randeree [1]

1:Lecturer, UAE University, College of Engineering, Al-Ain, UAE
E-mail: k.randeree@uaeu.ac.ae

ABSTRACT

The Internet as a tool for acquiring information from global sources has proved invaluable to engineering students worldwide as an aid to research in many areas of their study. Engineering departments, for their part, have responded by preparing courses that develop the skills of their students in using this technology.

The focus of this paper deals with the use of the internet in teaching students about the engineering profession. By the end of this course, students should have an understanding of the various engineering disciplines, an awareness of engineering ethics and have the ability to effectively evaluate a case representative of a well known engineering project. In addition, students with little or no prior knowledge of the Internet will have developed and honed their abilities in using it as an effective research tool.

Furthermore, the influences upon students to follow an engineering career, prior to freshman engineering is examined, as well as difficulties they encounter during the learning process in the Engineering Profession course. Course quality is discussed with a view to understanding accreditation needs and understanding the need for examining the learning outcomes of students.

Keywords: *Internet, Engineering Profession, ABET, Plagiarism.*

الملخص

تعتبر شبكة الانترنت كأداة لاكتساب المعرفة من مصادر عالمية ذات فائدة كبيرة لطلبة الهندسة على مستوى العالم ومساعدتهم فيما يقومون به من أبحاث في العديد من المجالات الدراسية. واستجابة لذلك فقد قامت أقسام كلية الهندسة من جانبها بإعداد مساقات تهدف إلى تطوير مهارات الطلبة في استخدام هذه الأداة التقنية الهامة.

يدور هذا البحث حول استخدام الانترنت في تثقيف الطلبة حول مهنة الهندسة، وينتظر منهم مع نهاية هذا المساق فهم المسارات الهندسية المتعددة و وأخلاقياتها واكتساب القدرة على التقويم الفعال لحالة تمثل مشروعاً هندسياً معروفاً. إضافة إلى ذلك ، سيتمكن الطلبة الذين لديهم قدر ربما يكون ضئيلاً من المعرفة المسبقة بالانترنت من تطوير وصقل قدراتهم على استخدامها كوسيلة بحث فعالة.

والاكثر من ذلك أن العوامل التي دفعت الطلاب الى اختيار مهنة الهندسه و الصعوبات التي يواجهونها خلال دراستهم لمساق مهنة الهندسه يمكن اختبارها و معرفتها قبل البدء في السنه الاولى من الدراسة. و عند مناقشة نوعية المساق يؤخذ بعين الاعتبار متطلبات الاعتماد و الحاجه لاختبار المخرجات التعليميه للطلاب.

1. INTRODUCTION

Rapid changes in the use of new technologies has given rise to the need for the content of engineering courses and the tools they utilize being continuously revised, altered and improved. Course development therefore becomes an ongoing and ceaseless process, with re-training of instructors being necessary and frequent in order to keep pace with advances and in order for these instructors (be they early or late adoptors) to comfortably appreciate and implement such technology, [McKenzie, 1999(a)]. Additionally, some observers feel that the entire educational system, not only in Gulf countries, but in the Arab world as a whole is in desperate need of an overhaul, [Al-Maeena, 1997]. Understanding the needs of company management is also important at the educational level in engineering departments, in spite of graduates often becoming part of a national workforce where employment is guaranteed. Employees need graduates ready to work rather than having to be re-trained on variations of a given technology.

The College of Engineering at UAE University, during the early period after its foundation (1980-1992), followed a classical curricular pattern similar to that dominant in the region. Realizing that tomorrow's engineer has to face the challenges of modern technology and the demands of modern society, the university administration initiated a major effort to modernize the engineering curriculum, to parallel the most recent international trends, particularly the curricula promoted in the USA as well as in many other countries.

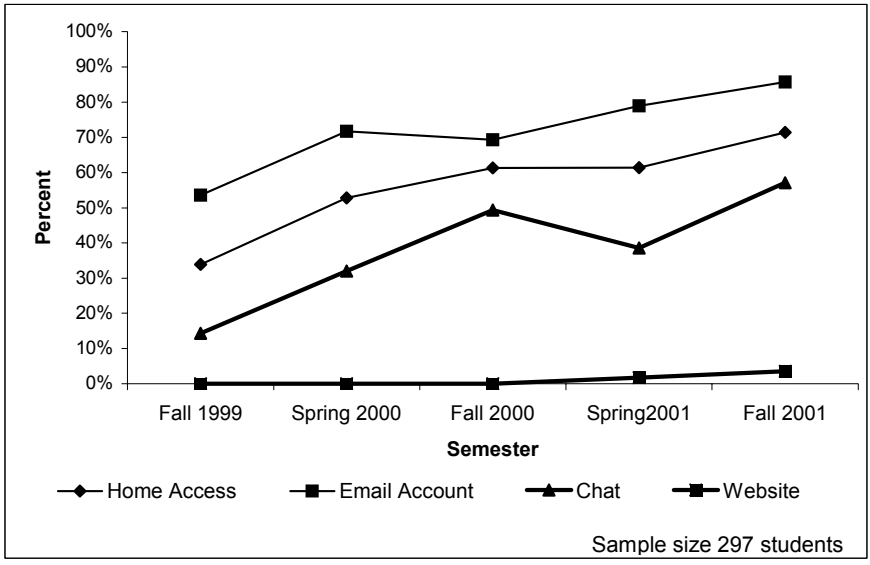

Figure 1: Changing trends in the personal online activities of freshman engineering students (1999-2001).

The Engineering Profession course dealt with in this paper focusses on the early awareness and exposure of freshman engineering students to the Internet. Many of these students have had no previous experience of information technologies, although in recent years a marked increase in personal online activity has been found amongst these students prior to joining the course, Figure 1. Analyses carried out at the UAE University is used here to demonstrate some of the advances as well as concerns and difficulties encountered in this field.

The methodology of the current work has utilized techniques for the evaluation of learning outcomes of students in line with ABET (Accreditation Board for Engineering and Technology) requirements, as well as the use of student questionnaires to evaluate student response to the course.

2. COURSE OBJECTIVES

The broad aim of the Engineering Profession course is to teach students about the engineer's role in society and to learn about the engineer's responsibilities to society, their employer and themselves. The learning process must enhance the students oral and written communication skills. Broadly, the course genre falls in the category of "complementary elements", defined as those courses that broaden the scope of the curriculum in order to ensure readiness of the student to understand the profession they are entering into, [Beasley et al, 1994].

The course also provides an overview of the work, need and responsibilities of professional engineers using a seminar-style self-learning format (including internet search), with students working in teams to research and report findings, discovering aspects of the engineering profession, career opportunities and gaining awareness of engineering ethics. Included in the Engineering Profession course is instruction in English for Special Purposes (ESP) to develop students' ability in the application of English as a second language. The teaching format for this course is thus unique to engineering with both engineering and english instructors working side - by - side in every class.

The computer and other information technologies revolutionized the way engineering is carried out many years ago. They are, however, only now beginning to revolutionize the way engineering subjects are taught, [Byron Pipes and Wilson, 1996]. Modernization of teaching methodology for the Engineering Profession course followed the trend adopted in the freshman year curriculum. Five courses were developed in 1996 and five more were implemented the following year. In the teaching of all these courses, the conventional lecture method in which the engineering instructor recites and demonstrates information and concepts was reduced to a minimum. In the newly developed approach, the engineering instructor is to assume the role of "manager of learning". In this format, the student is lead to a series of activities that will enable him/her to master fundamental concepts. Nowhere is the approach more evident than in the Engineering Profession course. Furthermore, this course facilitates

the student in two key educational areas. Firstly, the use of the Internet to facilitate the transition of students from passive to active learning. Secondly, the Internet's use in promoting independent and group centered learning skills as opposed to their prior experience of highly dependent learning.

3. COURSE CURRICULUM

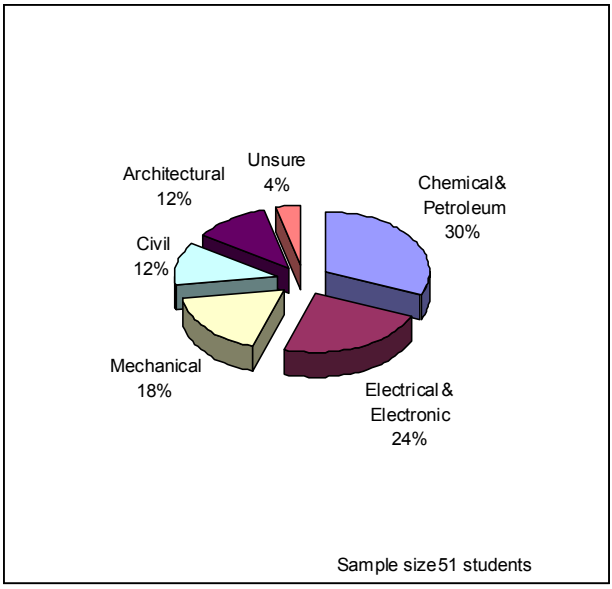

Figure 2: Initial thoughts of specialization discipline of students entering the College of Engineering.

The Engineering Profession course initially provides an introduction to the Internet for engineering students as well as technical report writing and presentation skills. The two primary benefits of the use of Internet technology here, is in student research and student communication, [McKenzie, 1999(b)]. These skills are then utilized in covering the three major projects. Project 1 gives a broad understanding of engineering careers, education, the main engineering disciplines and international engineering societies. Students gain an appreciation for these by searching the Internet and reporting their findings. At this stage, although students claim to be aware of the field of engineering which is of interest to them, Figure 2, further evaluation has shown that much of their pre-conceived notions about engineering and influences in following an engineering career path are not necessarily directed by an awareness of the subject, but rather, external pressures, Figure 3.

Project 2 focusses on engineering ethics by using case studies for discussion as well as the Internet for appreciating the various ethical codes engineers have to adhere to. Finally, Project 3 investigates a variety of engineering case studies which are pre-selected by the instructor with a view to providing experience of good and bad engineering practice. For each

project, students must complete worksheets, answering questions with the aid of the Internet. Furthermore, they must work in groups to produce a technical report of their findings and present their outcomes orally to the class using computer based visual aids.

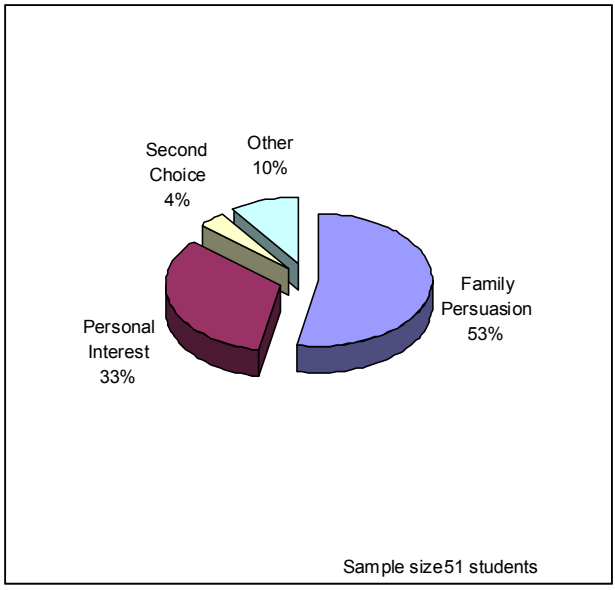

Figure 3: Influences on pre-freshman (engineering) students to follow an engineering career path.

4. LANGUAGE AND PLAGIARISM

The temptation for students to copy from Internet sources is very great, especially in the Middle East where English is not the primary language. Students who do try to use their own words are discouraged by the great number of linguistic mistakes that they make in spelling, grammar, punctuation and vocabulary, [Leake et al, 1999].

The sources of plagiarism vary depending on the type of work being submitted. Work in the Engineering Profession course, which is largely based on the writing of technical reports, with students being asked to carry out research using the Internet; students are often tempted to copy and paste large sections of websites directly into their reports. It is clear that "copying essays is a time honoured way of cheating, and its even easier on the internet which can help you downsize your workload by downloading someone else's work.", [BBC, 2000].

Although consistency with other international universities (USA in particular) is advisable for a coherent policy on plagiarism, cultural variation must also be taken into account. For example, student nature in the UAE and middle east in general, has a much greater spirit of cooperation than their contemporaries in the west. Although this, in itself is a noble attribute, such students will happily provide their work to a fellow student, without considering

themselves as unethical or copying his original work. In addition, the student copying his work will regard his colleague as merely helpful. In contrast, students in the west are more competitive and consequently more possessive of their own work. Thus, the nature of plagiarizing is more confined to copying textual and IT sources (Internet) rather than fellow students.

5. QUALITY ASSESSMENT

In order to assess whether or not teaching objectives are being met, instructors at the College of Engineering have analyzed data from student work in Semester 2, 2001. This analysis encompasses the expectations of the instructor and a numerical evaluation as to the compliance of the students with these aims.

Learning Outcome	ABET Category	Assessment Criteria	Expected Compliance	≥60	≥70	≥80	≥90
Search for specific information (Hands-on)	B.5	Internet Worksheet	≥70%	80	77	60	46
Understand professional, ethical responsibility (Professional Awareness)	F.1	Project 2	≥70%	88	82	41	6
Understand impact of engineering in global, societal context (Professional Awareness)	F.2	Project 1	≥70%	74	47	20	0
Awareness of contemporary issues in engineering, related areas (Professional Awareness)	F.3	Projects 1 & 3	≥70%	76	56	27	2.5
Be aware of role of engineering societies worldwide (Professional Awareness)	F.4	Project 1	≥70%	74	47	22	0
Write organized technical reports (Communication skills)	G.1	All Project Reports	≥70%	79	50	12	5
Present technical ideas orally (Communication skills)	G.2	All Project Presentations	≥70%	90	86	71	34
Use visual aids in their presentations (Communication skills)	G.3	All Project Presentations	≥70%	90	86	71	34

Table 1 : Evaluation of learning outcomes within the Engineering Profession freshman engineering course (Spring 2001).

Top

ABET outcomes are organized into twelve main categories [A-L]. The Engineering Profession course objectives are related to three of these as shown in Table 1. Specific learning outcomes were identified in line with ABET requirements, as well as work carried out by the student in meeting those outcomes. The numerical data shows that an instructor wishes to obtain a 70% satisfaction, Table 1. That is, 70% of the students must gain greater than a 70% score in each of the objective categories in order for this outcome to be deemed satisfactory. From the data, the students appear to have a good idea in using the Internet for searching for information but are lacking understanding of the impact of engineering in societies and the role of the engineering societies around the world.

At this early stage of quality assessment, this is a satisfactory methodology in gaining a broad understanding of student achievement. Whilst it remains difficult to correspond teaching and learning quality with such an evaluation method, it is envisaged to refine individual categories on a needs basis in the future. It is thus hoped that by carrying out an evaluation in the coming semesters, a useful set of evaluation criteria can be developed such that teaching quality and student learning can be assured.

6. STUDENT LEARNING

Students face a number of problems in using the Internet. Primarily, they have difficulty in locating and selecting relevant websites and information. They also lack techniques for recognising relevant material within a site and selecting only what is useful. Additionally, understanding large sections of authentic text is problematic as there is often too much data which is too difficult to comprehend with lack of understanding in the main points. Students can often not recognise the different text types and genres and cannot distinguish between factual and promotional language, as many web sites advertise a company or product. These problems are often overcome by narrowing the student scope, by, for example directing them to certain well known and researched references that the instructor is already familiar with, [Leake et al, 1999].

The Engineering Profession course demonstrates a significant improvement in the students' communication skills, but student motivation appears variable. Improvement has been noted in oral presentations given by students with most students gaining confidence. This is important, as UAE students notably have difficulty in obtaining jobs in the private sector largely due to poor communication skills, with engineeing students worldwide being recognized as poor communicators, [Davies, 1996]. Peer feedback is encouraged at the end of each presentation and most students use a variety of media to support presentations such as OHP, Microsoft Power Point, movies downloaded from the Internet, slide projectors and posters. In the majority of cases, students are using these for the first time. The students are encouraged to use various sources of information such as the library, Internet, personal contacts in industry and government ministries and approaching companies by phone or by e-mail.

Top

Students also take part in classroom discussions with marks awarded for in-class participation. In the second week of each project, students have to report their findings orally in a seminar-style draft presentation. This also encourages confidence and identifies weak areas of presenting skill with the audience being encouraged to ask questions. Students work in teams and are given an appreciation of working under pressure and adhering to strict deadlines. The importance of team work in the engineering profession is also vividly demonstrated as students become aware that some teams are more successful than others.

7. CONCLUSION

The use of the Internet as an educational tool has facilitated student understanding of the engineering profession in a global context. Furthermore, students gained an insight into the importance of effective research and communication skills, as well as becoming more active, independent learners. The need for group centered activities has also been demonstrated with students using the Internet as a research tool on an individual level prior to pooling thir information with colleagues to develop an overall understanding of the subject matter.

REFERENCES

1. Al-Maeena, K., (17th June) 1997, "Where is the Quality in Arab Education?", *Arab News*, Jeddah, Saudi Arabia.
2. Beasley, D., Biggers, S., Huey, C. and Liburdy, J., 1994, "A Process for Curriculum Renewal and Innovation", *Proceedings of 1994 Annual Conference and Exposition*, ASEE.
3. British Broadcasting Corporation (BBC), (17th May) 2000, "ClickOnline", http:// www. bbcworld.com /content/clickonline/clicklife.asp.
4. Byron-Pipes, R., Wilson, J., 1996, "A Multimedia Model for Undergraduate Education", *Technology in Society*, Vol. 18, No. 3, pp 387 – 401.
5. Davies, J., 1996, Communication for Engineering Students, Harlow:Longman, USA.
6. Leake, J., Bynom, T., Clery, D. and Aston, S., 2000, "Team Teaching: A Way Forward for ESP", *English Teaching Forum*, pp 38 – 42.
7. McKenzie, J., 1999(a), "Scoring High with New Information Technologies", *From Now On: The Educational Journal*, Vol. 8, No. 7.
8. McKenzie, J., 1999(b), "Strategic Deployment of Hardware to Maximize Readiness, Staff Use and Student Achievement", *From Now On: The Educational Journal*, Vol. 8, No. 8.