"You Have Provided Me With A New Set Of Tools And Taught Me How To Use Them": EMBEDDING GENERIC SKILLS WITHIN THE IT CURRICULUM

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ABSTRACT

The field of information technology (IT) undergoes incessant change, and the skills of the student to continue to lifelong learn in the context of change, are tested – even during a 3-year undergraduate course. This paper attempts to provide IT – specific applications of generic attributes using a working example to show how they can be embedded within a unit.

INTRODUCTION

For the past few years, much of the literature of higher education has focused on the development of a reflective teacher, who, understanding the needs of his or her diverse group of students, aims towards the development of a curriculum which will spark the students' interest, in the acquisition of generic attributes and skills in order to cope in a future working world of constant change (Raths, 1999; Prosser et al., 1990; Scott, 1998; Candy & Crebert, 1991; Candy et al. 1994a). This paper contains some reflections on teaching within information technology (IT), focusing on the development of a unit's curriculum aiming to enable students to evolve generic attributes and skills for IT graduates. This paper provides the background to research in progress, giving an indication of the current stage of this research.

Within the IT discipline there are generic attributes that a graduate should possess, just as with other disciplines. However, three aspects are fundamental: lifelong learning skills, an ability to independently learn, and information management skills. These skills require a greater emphasis from IT graduates if they are to remain employable for the foreseeable future.

Various learning theories have been used to help in the process of design of the unit. The underlying theories used were Saljo's (1979) original learning theories, Marton et al., (1993) six conceptions of learning, and Bruce's (1997b) *Seven Faces of Information Literacy*. The current interest across the world in the development of generic attributes that will help make graduates employable, also draws on these theories as building blocks, or steps, within the learning process.

If we consider how a student approaches learning and what generic skills they may require, then we can aim to focus on the needs of these students in the design of curriculum. This paper makes no attempt to outline the various learning approaches students may use, but simply aims to use a case study to show how generic attributes can be embedded within the curriculum of an existing IT unit.

GENERIC ATTRIBUTES AND SKILLS

This conference is one of many workshops, seminars, and conferences for the higher education (HEd) sector, devoted to lifelong learning. A major aspect of lifelong learning is the development of generic skills, and the literature of the HEd sector reflects the interest in this aspect (Candy et al., 1994; Clanchy & Ballard, 1995).

As a simple example, the following quote highlights the problems faced by a graduate of the engineering or IT fields if they wish to remain employable throughout their working life, and the importance of lifelong learning.

> "In the dark oak cabinet behind his desk, Rudy Herrmann keeps a slide rule. ... Herrmann, the president and CEO of Dover Resources, Inc., ... carries this fossil to his guest lectures at engineering colleges. He shows it to the students and explains that this was his computer when he wore their shoes 25 years ago. If the twenty-something engineers laugh incredulously or scoff that Herrmann himself could be the real fossil at the podium, they have merely helped him drive home his point. ... "Look how far we've come since this slide rule," he says, "and remember that 25 years from now, the laptop computer might be obsolete, too. Your learning is just starting" (Minton, 1998, p 14).

How many of us can relate to this? I remember learning to program using punched cards 20-25 years ago, with no laptop computers, and the computer that was used by a whole university, having less memory than a desktop workstation has today.

> "Within many vocations, technology is changing at such a rate that one's occupational preparation can become obsolete in a matter of years" (Candy et al., 1994, p 34).

Perhaps more so than in any other discipline, the field of IT undergoes incessant change, and the skills of the student to learn in the context of change are tested even during a 3-year undergraduate course. IT talks in terms of 'Internet years' which pass five times faster than normal years (Edwards, 1999). If you consider the phenomenal growth rate of the Internet, and the fact that for the last ten years the size of the Internet in host domain connections has doubled approximately every twelve months (Edwards, 1999), then you can see the problems faced by IT graduates. The Internet is only one section of the IT industry, but it highlights the constant changes faced by an IT professional throughout their working life.

IT specific generic skills

All graduates must be able to see new things in a new way, and change their thinking to reflect the new theories and developments they will be exposed to. For the IT graduate, this need is highlighted by their industry, and they must strive to maintain an ongoing awareness of their industry and its new developments in order to remain employable throughout their future careers.

At QUT (Queensland University of Technology) the Faculty of Information Technology (FIT) has identified a list of generic skills and attributes that are required of an IT graduate. They include knowledge or problem solving, ethical or attitudinal, and social or relational aspects. Of these, there are three areas which are fundamental to successful learning in the discipline of IT. They are the ability to acquire lifelong learning skills, an ability to learn independently in a constantly changing industry environment, and excellent information management skills in order to sort through the problems of information overload and develop an awareness of the latest essential developments in the industry. These three aspects summarise, to some extent, all the skills included in the FIT MOPP (Manual of Policy and Procedures) skills above, and work together for lifelong employability in IT.

Lifelong learning skills

The FIT graduate is expected to be capable of critically reflective thinking, have developed problem-solving skills, have good communication skills, and a sound working knowledge of their discipline. From learning theories (Marton et al., 1993; Bruce, 1997b) it is evident that the skills of the lifelong learner can be summarised as to encompass all of these things as well as the ability to increase their knowledge, both in memory and reproduction, to apply and understand what they have learnt, and have the ability to see and appreciate things in a new way.

Key to the concept of lifelong learning is information literacy. Undoubtedly, if someone has developed a love of learning, a sense of curiosity, and a critically reflective spirit, then they will have some of the stepping stones in place for lifelong learning. However, without also understanding the major information resources available in a professional field, without an ability to decode information from a variety of formats (Candy et al., 1994, pp 43-44), then the path of lifelong learning will be strewn with obstacles.

Attempts to define information literacy simply, have been made. They include the following:

> "Information Literacy is the ability to access, evaluate and use information resources from a variety of sources" (Doyle, 1992, p 2).

> "...ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organised, how to find information, and how to use information in such a way that others can learn from them" (American Library Association 1989).

> "Information literacy is not a discrete set of skills, but rather a 'way of learning'" (Kuhlthau, 1993).

Within the field of IT, information literacy should include the ability to use IT appropriately for ongoing information awareness and communication skills, the ability to find appropriate information either independently or with the help of an intermediary, and the ability to use the information found for problem solving (Bruce, 1997b). Furthermore, IT professionals should be able to use the information to create new knowledge in the workplace (Bruce, 1997a).

Ability to independently learn

The ability to independently learn throughout the remainder of their life is also recognised as an important attribute, to have developed before graduation. The graduate should be self-motivated, and possess a basic curiosity to continue to learn about the changes in IT, in order to continue to develop professionally. Most importantly, in a discipline where the law is one to three years behind the advances in the technology[1], a basic set of ethical principles is also paramount. The IT student will be continuing to learn about new technology and advances in their fields, often without the support of the legal system. They will have to ensure they follow a moral standpoint, based on similar precedents, and consider that if something is not illegal now, it may well be so in the future.

Information management skills

Within IT, the amount of information vastly increases each year. Given IT talks in Internet years, if you consider how much information comes across the average worker's desk in one year, and multiply that by five, then you can easily imagine the information overload of an IT professional. Without the skills to prioritize, to work as part of a productive team, or independently if required, then the IT professional will struggle to maintain their own ability to lifelong learn. This is, therefore, a core skill. The IT professional must be able to manage information, to use the new information found, and to build it into an ever-developing personal knowledge base for their professional working life (Bruce, 1997a).

EMBEDDING GENERIC SKILLS WITHIN THE CURRICULUM

Having considered what are some of the essential generic skills, we then attempt to develop a learning environment to help students. There are a number of areas which need to be addressed. These must include materials that will encourage the student to broaden their knowledge base, and yet allow a certain flexibility to develop their own independent interests in the field of IT. The materials of a unit being taught should also provide a structure that allows the student to develop a greater responsibility and a mechanism for self-direction (Candy et al., 1994).

ITB322 Information Resources

Within the QUT unit ITB322 Information Resources, I have attempted to incorporate these structures within the curriculum. In the unit, diaries and team projects are used to foster information literacy, particularly the development of communication and practical problem-solving skills. This is done in the context where students learn to identify, retrieve, and evaluate print and electronic business information resources that are relevant to a variety of problems; thereby applying their knowledge in Internet, Intranet, and virtual-library environments.

ITB322 unit scope

Primarily the unit is designed for the students to learn about a variety of information resources and their uses, independent of the format of those resources. The curriculum aims to cover information retrieval techniques, user needs analysis, databases, commercial information providers, traditional published sources (monographs, journal articles, patents, standards, government documents), people, and the Internet. The students are therefore exposed to information resources which will be useful in their future careers.

ITB322 audience

The primary group of students enrolled in the unit each semester is the group within the BIT (Bachelor IT) Information Management major stream. There are secondary groups who enrol in the unit as an elective unit. These students are either from other majors within the BIT or from any other faculty at the university. The unit has attracted up to 65% International students in some semesters, and students with a wide range of course backgrounds (science, engineering, nursing, law). This means that the students in the secondary group are not always computer literate.

ITB322 main issues

Obviously there are problems with the diverse student group, and the different computer literacy skills within the unit. I have also noticed that there is a variety of ways in which students tend to approach a problem. Some students do not want to talk to the lecturer or tutor at all, some talk and e-mail incessantly, some panic over their lack of IT skills, not an approach to a problem and many want the "magic 7" (or A Grade) result without having to deal with the issues.

1 For example, the law has not yet developed to the point where traditional legal contractual requirements can be reliably handled electronically; and yet the technology, like digital signatures for electronic contracts, already exists. At present, if the proposed electronic contract is important, then it is necessary to confirm them-in hard copy; or it may not be a valid contract (Greif, 1999).

In order to help overcome some of these issues, a number of strategies have been put into place. The tutorials have been replaced by PC Laboratory sessions, with a skilled tutor present, thus allowing time for searching and skills refining. Considerable time is devoted in the first two weeks to match students who are computer illiterate with students advanced in computer literacy. Various other techniques are also used, such as Internet Relay Chat on assignment topics, 'getting-to-know-each-other' exercises to break the ice, and Internet Hunts to help identify which students need the most help.

ITB322 pedagogy and assessment

Considering the generic attributes and the curriculum of ITB322, I would like to see the students become information literate, Internet literate, resources literate, have developed good communication skills, the ability to work in teams, and have developed a sound selection and evaluation process.

Three items of assessment are used to address these for the unit: a reflective journal, an information consultant's search, and a team project. The primary method used to help in the development of these skills is the reflective journal, as it underpins the student's work throughout the semester.

Reflective Journal

Each week, the students are asked to complete a diary or journal entry. Entries are read each week and signed by the tutor or lecturer, and returned at the following class session. Individual weekly entries are not marked. However comments are made and questions answered, to guide the students. A mark is allocated at the end of the semester after the complete journal has been submitted.

This journal is used as a means of encouraging students to interact with the material they are presented with for the semester. The students are asked to critically reflect upon, and summarize the content of, lectures, tutorials, set readings, field visits, and information from all other units or life in general where it may apply to the unit only. Given the unit is about information resources in whatever format, this should help the students to develop some methods to help with information overload. At the same time, they should be slowly working towards problem solving, good communication skills and, of course, the ability to critically reflect and develop creative thinking.

The diary has become the main focus of all assessment. The purpose of the diary, therefore, is to help students to:

1) maintain an awareness of how well they are keeping up to date with the required or enrichment readings each week;
2) keep track of any lectures missed, and plan ahead for 'catch-up' study;
3) identify any difficulties they are experiencing in the unit or assignments;
4) analyse their own 'information' received: how it may relate to their future career; both in preparation for their career and in possibly developing an ongoing information resource handling style, and a reflective approach to their own work;
5) have a feedback mechanism where they may suggest 'constructive' adjustments to the subject unit that they think might be helpful for the learning experience or for their future careers.

Pros and Cons: I know when a student is struggling, and I can offer more assistance when necessary. I know if most students were confused by a given topic, and I can address that quickly within the semester. Marking does take a large amount of time each week (50-70 students takes about 2-4 hours). It takes the students time to develop the ability to critically reflect upon the week's materials. The major problem is that students who want the 'Magic 7' result tend to write more – not better! To overcome some of these problems, students are now limited to no more than two pages, with 1½ line spacing each week. They are given an approximate mark for content each week.

Overall, students mostly develop critical independent thinking and great communication skills somewhere around Weeks 7-10 of the semester, and the entries each week become very high quality and much shorter.

Information searching

For this assignment the students are given a choice of four topics. The students are asked to assume the topics are for a client. In this manner, they are asked to meet the needs of an end-user, and match client expectations with the final product. Each student chooses one topic and will then work to retrieve a total of 10 to 25 highly relevant items from the library CD-ROM network, the Internet, the Dialog Online database search service (over 450 databases), and any other information resource that the student feels is relevant. To help the students achieve this, the scheduled tutorial and laboratory time for the first seven weeks of semester is dedicated to providing search access to CD-ROMs, Dialog, and the Internet – with help from the tutor.

At the end of this process, the student must present the final results, as well as a detailed report on the search process. The students are asked to discuss why their strategies are different for different databases and tools, and why the searches produced different search results. In this way, they need to think about the end users needs – what they are really looking for when they search – and then match the information needs to end results. They learn about changing their strategies across different search tools and databases, and evaluating resources.

Pros and Cons: This researching process, based on a limited topic choice, helps encourage lifelong learning skills, the ability to independently learn, and the ability to manage information overload. The students each experience their own way of finding information for this report. They tend to approach this in a variety of ways. Some students simply attempt to 'fact find', others try to balance the information found against their own personal viewpoint of the problem, and others attempt a depth of analysis which is genuinely attempting to meet the needs of the end-user.

Team Project

The final item of assessment is a team project with two or three people. Students are encouraged to select an area that they may like to work in on completion of their degree. Together, the team produces a 'resource guide' to the subject area of their choice. In this way it is hoped that the resource guide produced may be a useful tool in their future careers. The team is to attempt to list only the best of the major resources that would be required to solve most questions encountered when working in the subject field, and will therefore also be of use to regularly keep updated in the subject area. The team is expected to evaluate the resources as if they are a team of professional information consultants.

Pros and Cons: The resource guide should include what the team considers to be essential information resources in the chosen professional subject field, and what should be scanned regularly to keep up-to-date. It is hoped that the guide therefore becomes an important tool for the students in their future career in order to help with information management skills, and their lifelong learning. Some students do not achieve this. There are also occasions when the teamwork in some groups leaves a little to be desired. On average, one group per semester seems to have a major problem. If they report this in their weekly diary entries, then the teaching staff can help to resolve problems. If they do not report this, it is possible that this problem will remain unnoticed, and that teamwork skills will not develop well within the group.

ASSESSING WHETHER IT HAS WORKED?

So how do I know that the work to embed generic skills within the curriculum of ITB322 has worked? I do not yet have a definitive answer to that. I will be attempting to address this more fully in the future, with further research. At present I am in the process of designing a phenomenonographic study of how students approach learning in a constantly changing IT environment. It is hoped that this research will shed further light on the design of this, and other, IT units.

However, I have had constant feedback about how students have approached assignments and when they need more help, which from the teaching and learning perspective can only help continue to improve the unit and the learning experiences of the students.

Furthermore, I have had comments in the completed journal entries, including the following:

> "This has helped in all other unit assignments" (Male student).

> "I wish this subject had an exam. I think I'd do great in it thanks to this journal. I'm going to do this for every other subject in future" (Male student).

> "I viewed the diary as an excellent opportunity to not only reflect on the work – but to extrapolate other ideas and readings" (Male student).

> "I found having to compose a summary of the lectures each week was actually a valuable form of study. In its own way it forced me to think about what I was supposed to be learning, and you know, I think it was successful in it's mission" (Female international student).

> "Initially I had misgivings about handing up weekly diary entries. It seemed like a lot of trouble and required some adherence to setting aside a few hours every week, thinking and writing these entries. But, after reviewing my entries for the past few weeks, it certainly brought back fond memories... without the diary entries I would not have remembered what I learnt each week. And I would not be able to air my weekly grievances" (Female international student).

CONCLUSION

Learning theories state that successful learning includes the students' ability to increase their knowledge, to memorise and reproduce that knowledge, to apply it and understand what was done, to see something in a new way, and finally, to change as a person (Marton et al., 1993). Furthermore, information literacy is a major part of the lifelong learning process that all graduates need in order to remain employable. I believe the assessment in the unit design works towards the development of these skills.

There are a small number of students each semester, who do not achieve what I had hoped for them. Their journal entries have not developed, nor changed, and the students seem not to have understood what was taught throughout the semester. However, these are in the minority.

The majority of the students have shown significant change. The students' comments, included above, demonstrate how effective the process of embedding generic skills within the unit has been to date. The students themselves state that they could remember what they had learnt, had improved their searching skills, could extrapolate other ideas and readings, were forced to think and critically reflect, were now able to keep up-to-date, and found the skills transferable to all other units.

I have also had feedback, via e-mail from a student of the unit from 1997, stating how much they still feel the unit has continued to help them two years after graduation.

> "i might not have said this before but the IR unit has really improved my search skills. before i left the previous company, i was doing some minor projects, and man, was everyone surprised at how fast i managed to get information on some things" e-mail from a 1997, male, international student, received in Aug. 1999)

Finally, and most comprehensively, using the words of another student, the students found that they had *"been provided with a new set of tools, ... taught how to use them and [that] this will enable [them] to go on deriving benefit from [the units materials] long after the lectures and tutorials have ceased."* Surely, this is what we are trying to achieve when we encourage our students to move towards lifelong learning and the development of numerous other generic skills.

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