Enhancing Teaching and Learning through the Incorporation of Generic Skills for Civil Engineering Undergraduates

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Abstract - In facing the challenging and competitive environment, the institutions of higher learning must constantly keep abreast with the needs of the engineering workforce at the industries. Engineering graduates who are competent with certain skills may be able to secure employment without great difficulty. Such skills are well-known as generic skills. It has been increasingly important in most developed countries over one decade ago because it assists graduates to function effectively in today's era of globalisation and the challenging world ahead. Firstly, this paper outlines the definitions and importance of the attributes of generic skills. Secondly, it discusses on the experiences in implementing generic skills in several countries across the continents as well as the local scenarios. Upon realising the importance of generic skills, Fakulti Kejuruteraan Awam (FKA) of Universiti Teknologi Malaysia (UTM) has embarked on an exercise to incorporate such skills in the teaching and learning of civil engineering course subjects at the undergraduate level. This paper also discusses on some stages of development in incorporating such skills that have already been taken place at the faculty. The experiences and challenges in the planning, implementation and assessment stages are also elaborated. Finally, this paper makes some recommendations in respect of further works that can be very valuable in order to boost up the employability of civil engineering graduates.

1. Introduction

In the last few years, most fresh civil engineering graduates are facing many different challenges and competitions in seeking employment as compared to their earlier generations. Despite qualifying with academic degrees, many employers express their concerns about the handicaps or inadequacies in fresh civil engineering graduates and the lack of competencies or capabilities that what we mean as generic skills [1]. In a survey conducted in 1995 by the Association of Graduate Recruiters in London, the study findings of the association have expressed that most unemployed graduates are lacked of some essential skills in order to be easily and promptly employed [2]. Currently, similar situations are taking place in Malaysia. In a competitive working environment, the whims of the industries, the advancement in technologies and the globalisation of world markets require new employees to acquire certain skills so that they can always remain competitive to meet any challenges. Most industries have high expectations on fresh graduates that have already possessed with such skills since they do not have the leisure time and luxury resources to send them for training at professional instruction centres. At the moment, it is evident that such skills are part of the requirements when corporate organisations advertise their job vacancies in the media and the press.

2. Categories of Generic Skills

In brief, generic skills are the non-technical skills that are highly associated with employability and such skills can be applied across a variety of system domains, for example, work productivity, and community life. Since it originates from the word "general", generic skills are the over aching skills, qualities, knowledge, abilities and traits that a person should possess in order to succeed on one's education and career [3]. Depending upon which countries on the continent they are using this term, generic skills are sometimes referred to as the employability skills, transferable skills, core skills, essential skills, soft skills, core competencies and the critical enabling skills.

Such skills will develop over time and can be transferred to or applied to the workplace. With such skills, graduates are able to function and contribute effectively in solving problems, communicating effectively, thinking creatively and function effectively in teams or groups. Even though the generic terms used to describe such skills vary from countries or institutions and depending on how they are categorised, it is observed that they are almost similar to one another.

Several types of generic skills that are deemed desirable amongst engineering graduates are categorised as follows:

a. Communication skills – the ability to present ideas with confident and effective through aural, oral and written modes.
b. Interpersonal or teamworking skills – the ability to work, adapt and interact with people of varied background or discipline, within or across organisations.
c. Problem solving and decision making skills – the ability to apply problem solving strategies in situations where the problems and solutions are clearly evident and in situations requiring critical as well as innovative thinking, to achieve the desired outcome.
d. Analytical or numerary skills – the ability to analyse problems in a structured manner using mathematical and scientific approach.
e. Lifelong learning and technology application skills – the ability to continue learning independently in the acquisition of new knowledge, skills and technologies. Nowadays, the use of information, communication and computing technologies are very essential in the knowledge-based era.

3. Global Trends across the Continents

In United States at Harvard University, a survey that was carried out in 1990 has found that the technical competency of fresh graduates is high whereby they are able to crunch numbers and analyse share markets. But when it comes to human-relation skills, Harvard University is putting up her effort to improve the quality skills of the students. They are oral and written communication, teamwork, and other human skills. In succession to this survey, in 1992 the United States Secretary's Commission on achieving necessary skills (SCANS) has come up with a number of studies on generic skills.

Likewise, similar studies have been carried out in the United Kingdom via the British Task Force and in Australia by the Education Council and Ministers of Vocational Education, Employment and Training. The definitions and the study comparisons of generic competencies or skills in the three countries across the continent that included New Zealand are reported by Moy [4] and are summarised in Tables 1 and 2. As a result of many studies, there are several models that can be identified in classifying the generic skills.

Table 1: Comparison of Generic Competencies

Australia	United Kingdom	United States	New Zealand
Key competencies	Core skills	Workplace know-how	Essential skills
Collecting, analysing and organising information	Communication	Information Foundation skills: basic skills	Information skills
Communicating ideas and information	Communicating Personal skills: Improving own learning and performance	Resources Foundation skills: basic skills	Communication skills
Planning and organising activities	Personal skills: Improving own learning and performance	Resources Foundation skills: personal qualities	Self-management skills Work and study skills
Working with others and in teams	Personal skills: working with others	Interpersonal skills	Social skills: Work and study skills
Using mathematical ideas and techniques	Numeric: application of numbers	Foundation skills: basic skills	Numeric skills
Solving problems	Problem-solving	Foundation skills: thinking	Problem-solving and decision-making skills
Using technology	Information Technology	Technology Systems	Information skills Communication skills

Source: Moy, J. The Impact of Generic Competencies on Workplace Performance, NCVER, 1999.

On above all, the United Nations also conducted some studies to develop a model that based on three clusters, namely the core values, core competencies and managerial competencies. Whereas, Keans [5] proposed several clusters of generic skills to cognitive cluster, interpersonal cluster, enterprise, innovation and creativity cluster, and lastly work readiness and work habits cluster. Note that these broad based of cluster models are also links to the core values, core competencies and management competencies.

In 1997, the issues of graduate employability in the United Kingdom have been widely discussed and a report from the National Committee of Inquiry into Higher Education (Dearing Committee) has been produced [6]. From that report, it is recommended that all institutions of higher learning should begin to develop all course programmes they are offering contain programme specifications that outline the intended learning outcomes. Such outcomes must be clearly spelled out by the students about the knowledge and understandings as expected upon full completion of the course programme. The important key skills that need to be addressed are communication, numerical, the use of Information Technology and ability on how to learn effectively.

In addition, other skills such as understanding of technologies or ability in critical analysis as well as subject specific skills need to be addressed too.

Table 2: Key Competency Definitions

Collecting, analysing and organising information	The capacity to locate information, sift and sort information in order to select what is required and present it in a useful way; and to evaluate both the information itself and the sources and methods used to obtain it.
Communicating ideas and information	The capacity to communicate effectively with others using the range of spoken, written, graphic and other non-verbal means of expression.
Planning and organising activities	The capacity to plan and organise one's own work activities, including making good use of time and resources, sorting out priorities and monitoring one's own performance
Working with others and in teams	The capacity to interact effectively with other people both on a one-to-one basis and in groups, including understanding and responding to the needs of a client and working as a member of a team to achieve a shared goal.
Using mathematical ideas and techniques	The capacity to use mathematical ideas, such as numbers and space, and techniques such as estimation and approximation, for practical purposes.
Solving problems	The capacity to apply problem-solving strategies in purposeful ways, both in situations where the problem and the desired solution are clearly evident and in situations requiring critical thinking and a creative approach to achieve an outcome.
Using technology	The capacity to apply technology, combining the physical and sensory skills needed to operate equipment with an understanding of scientific and technological principles needed to explore and adapt systems.

Source: Moy, J. The Impact of Generic Competencies on Workplace Performance, NCVER, 1999.

In Australia, it seems that the issues of generic skills have been addressed very much earlier. They have gone through it for the past ten years and in the middle of reviewing their actions. As a consequence of these issues, most web sites of the institutions of higher learning in Australia will focus their deep commitment and high achievements in implementing generic skills in teaching and learning. Monash University, Griffith University and University of Queensland are amongst the champions of universities since they are already in the forefront on the development, planning, implementation, assessment and reviewing stages for the betterment of producing world class university graduates.

In assessing generic skills, a series of case studies has been investigated by Clayton et al. [7] on how generic skills were being assessed and certified. In their investigation, it was revealed that a broad range of approaches was being used in the assessment of generic skills. It was also found that most assessors were more confident in assessing generic skills as discrete units of competency rather than when they are incorporated into the subjects. In order to achieve a successful assessment, the students needed to be given explicit information about what were required for the assignment and most students loved to participate actively in the assessment process because they could feel parts of the process were being assessed. In the mean time, the assessment approaches need to be integrated, comprehensive and quality assured.

4. Some Challenges for the Local Graduates

As compared to graduates across the continents, similar challenges are also facing our local graduates. The report written by Low (Meeting the Needs of Industry: The Challenges to Training and Education) and Majlis Tindakan Ekonomi Malaysia (Employability of Malaysian Graduates) should have triggered us about teaching and learning methodologies at institutions of higher learning in order to meet the various needs of the industry. Due to unforeseen circumstances, local graduates are often trapped in a situation without any clues given due to dynamic and global changes of the industrial environment. The important key issues that need to be addressed and reformed to local graduates are the ability:

a. to use technology to acquire information
b. to form networking with people of other disciplines
c. to understand inter-related issues of business, society and organisation
d. to add value in order to gain competitive advantage due to demand for creativity, lateral thinking, agility and risk taking
e. to search information from raw data and subsequently to use it as a tool for decision making.

At the moment, most industries expect the local graduates are able to perform satisfactorily on any given tasks after being appointed as a new employee since they do not want to waste their valuable time and resources. However, if the industries were to send the local graduates to attend few short courses for their needs, it is afraid that after having gone through such training, the local graduates might quit that company and later join another company that will offer them better in terms of higher salary and perks. Although it is unethical to pinch a newly trained employee from another company, but the former company has no right to hold that person unless there is a contract agreement between the two parties. That is why most industries are unwilling to send-off their staff for retraining unless it is very necessary. Since there are abundance of unemployed local graduates who are considered unskilful

according to the needs of industries, the institutions of higher learning are being burden to produce future engineering graduates that are not only competent in technical know-how, but they are also possessed with generic skills that are very valuable to the industries. As expected by the industries with regard to generic skills attributes, the local graduates should be very independent, initiative, creative and motivated in order to be very competitive and versatile amongst themselves.

5. Meeting the Challenges for UTM Graduates

Indeed attempts to incorporate generic skills among students are actually neither new nor rare. Many engineering academic staff has consciously or subconsciously applied or incorporated generic skills in their teaching and learning approaches. Even at the primary and secondary school levels, these skills are integrated into the teaching-learning materials and classroom activities. Therefore, it is important that planned efforts should be made to ensure that the application of generic skills among undergraduate students in the higher learning institutions be continued.

In line with UTM's vision and mission, UTM has committed to produce engineering graduates who are not only competent, creative and versatile professionals who are also guided by high moral and ethical values in the service of God and mankind, but they are also possessed with generic skills that will encounter or prepare them with employment markets and job seekers. Hence, in order to accept such challenges and competitions, UTM needs to produce engineering graduates who have a sound self-disciplinary and professional knowledge, high self-esteem and effective skills in communication, teamworking, problem solving and lifelong learning.

UTM has identified a range of attributes and generic skills which will enable our engineering graduates to function effectively in a wide range of social and professional contexts. The development of such attributes will be embedded within the contexts of the students' discipline or professional field. In general, the communication skills, teamworking, problem solving, adaptability, lifelong learning, self-esteem and ethics and integrity are amongst the attributes that need to be focused.

In April 2004, FKA organised a workshop for FKA academic staff for incorporating generic skills in the teaching and learning of selected civil engineering course subjects at the faculty level. In this workshop, the above mentioned attributes were addressed, conveyed, shared and discussed with the academic staff whereby the process of incorporation of such skills must follow through three main stages,

namely, the planning stage, implementation stage and assessment stage of generic skills.

5.1 The Planning Stage

As far as FKA is concerned in incorporating generic skills into the civil engineering undergraduate programme, FKA is in the forefront in organising a 2-day workshop in April 2004. In this workshop, FKA has ambitiously identified several civil engineering subjects that can directly instil general skills in the learning and teaching phase of these subjects for the academic session 2004/2005 and onwards. This strive is also inline with the requirements of the Engineering Accreditation Councils of Malaysia, the Board of Engineers Malaysia and the Quality Assurance Department of the Ministry of Higher Education Malaysia, and also the Accreditation Board for Engineering and Technology (ABET).

The prime purpose of this workshop is to review a set of specific learning objectives and outcomes for each subject. In this planning stage, the strategic decision is to reinforce the overall subject course specifications as well as listing out a definite number of generic outcomes that can be made transparent for FKA academic staff and the students to comply with the above requirements in the classroom lectures. In fact, it is identified that not all generic skills can be easily incorporated into the course subjects since a few specific generic skills may dominate in one particular course subject and moreover, some generic skills are hardly able to be discretely assessed. Once all the course subjects and the types of generic skills have been identified, a checklist or subject mapping can be orderly schematised so as to ensure that the incorporation of generic skills are developed and reinforced across the spectrum of course subjects in the entire civil engineering curriculum. Also, the output of this workshop has included generic skills that need to be addressed in the revised description of subject course documentation of Course Note Level 1. Hence, the consequence of this workshop is on the verge of the implementation stage of incorporating generic skills as required by the above accreditation bodies.

5.2 The Implementation Stage

Once the entire civil engineering curriculum and subject course documentations are well planned ahead and documented to incorporate generic skills and they are then ready to be deployed, of course FKA academic staff will have to put the plans into actions. However, in the initial phase of implementation stage only some subjects are identified and ready to be deployed. This is to control on the implementation stage by not over-doing the

incorporation of generic skills rather than on the main contents of the course subjects.

In the incorporation of generic skills in the civil engineering subjects, two programme activities have been categorised. The first category is in-class activity such as classroom discussions, group works, presentations, as well as play roles and simulations. Whilst the second category is out-door activity such as field assignments, project reports, independent study, field trips and site visits. It should be noted that the above activities will depend on the type of generic skills to be instilled and enriched and also the actual contents of the course subjects. In choosing the appropriate form of programme activities whether it is in-class room or out-door, the number of students, the type of students, the availability of the resources and the subject workload credit hours are also important factors that need to be considered.

5.3 The Assessment Stage

Since generic skills are considered important components in the learning outcomes either at the programme activities or course subject level, then such skills need to be assessed accordingly. Therefore, the assessment process needs to identify, prepare, observe, measure, collect and analyse such skills in order to evaluate the performance of students' achievement of the course subject. This exercise is in accordance with the requirements of the Engineering Accreditation Councils of Malaysia, the Board of Engineers Malaysia and also the Quality Assurance Department of the Ministry of Higher Education.

Generally, the assessment of learning outcomes of course subjects is purely based on subject contents and not on generic skills. Although it has been suggested to assess generic skills, there is no doubt that this task is a difficult stage to implement. In the normal assessment of course subjects, the academic staff evaluates the performance through quizzes, tests, assignments, presentations and examinations. Questions in the form of higher order cognitive skills that require synthesis, analysis, application and evaluation will be more simple and effective to adopt. Whereas in the assessment of generic skills of course subjects, brief and verbal instructions or procedures given to students for the conduct of assignments may develop such skills as attentiveness and alertness that have to be acquired by the students in order to submit full completion of the assignments.

For the overall assessment of course subjects in relation to generic skills, a substantial portion of assessment marks must be allocated in order to evaluate rewardingly the demonstration of such skills. Skills like presentation, participation, communication, teamwork and problem solving are considered quite easy to assess since the performance criteria are quite straight forward. In doing so, some

performance criteria are set up and appropriate scores or grade values are given to the criteria to reflect their importance of effectiveness, orderliness and rankness of such achievements.

Another key issue in the assessment stage is the tools used for assessing the generic skills. There are many methods that are readily available to measure the outcomes of generic skills and each method has its own advantages and disadvantages. For example, peer assessment is one of the methods used in assessing teamworking. By using this method it will somehow relief the burden of the academic staff in assessing the teamworking skill, especially to a large number or group of students. Typically, the results of peer assessment have shown that most of the students generally gave maximum scores to everyone in the group. Perhaps, this is probably due to the culture of "*semangat gotong royong*", whereby helping one another is always a dominant factor, even though it is noticed that not all members in the group really participate equally well when executing the given tasks. Thus, some sort of moderation and monitoring by the academic staff is deemed necessary.

With respect to other attributes such as self-esteem and integrity, it is found that difficult to implement and assess in the engineering based subjects. As a consequence of this difficulty, such skills are incorporated into the humanities, management, English language and the co-curriculum subjects.

6. Recommendations

As discussed earlier, the learning providers or academicians are very much concerned and committed to give significant impact in instilling generic skills for engineering undergraduates so that they can encounter the employment markets that are very challenging and competitive. The institutions of higher learning should offer great support by planning, implementing and assessing generic skills since at the end of the day, the students need to realise the importance of acquiring such skills for the survival of the fittest. Therefore, by utilising of learning portfolios as created by the students themselves and the application of self-assessment tools are highly recommended. They must also make full commitment and participation for developing some specific generic skills for the good cause and benefit of themselves. After all, they are the ones that require such skills in order to enter the job market.

In the overall development of generic skills, it requires a full cooperation, participation and partnership between students, learning providers and the industries. In order to assess the impact of incorporating generic skills as needed by the industries in offering employment, the feedbacks from the industries through surveys and

questionnaires are very much desired for continual improvement and development.

As far as assessment is concerned, several approaches are required to give a better representation of the student performance. A better mechanism for communicating and transferring generic skills to the students, learning providers and industries should also be provided and enhanced.

7. Concluding Remarks

In conclusion, generic skills have become an important issue in the job market for the learning providers, students and the industries. This paper has outlined the reasons both locally and globally on its importance of incorporation of generic skills at the institutions of higher learning. It also provides a framework on how to incorporate such skills in the teaching and learning phases of course subjects. Finally, it boils up with some suggestions and study recommendations for further work.

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