Engineering Skills Courses in the Engineering Programs

Said Amirul Anwar Ab Hamid, Sharulnizam Mohd Mukhtar, Abdul Rahman Mohd Saad

Pusat Kejuruteraan Universiti Malaysia Perlis (UniMAP), 02000 Kuala Perlis, Perlis, MALAYSIA. Email: said@unimap.edu.my

Abstract

Engineering students need to be equipped with engineering skills with practical hands-on experience prior to their graduation from the academic institution into the industries. Become aware of that scenario, engineering skills courses such as Engineering Skills I and Engineering Skills II have been introduced into the first and second year of the Universiti Malaysia Perlis (UniMAP's) engineering curriculum. These courses require students to spend time doing practicals in order to develop their skills in laboratory or workshop every week throughout the semester. In this paper, we discuss the content of the courses and the lab-intensive approach that has been applied in serving the needs of the engineering students with valuable hands-on skills. The facilities available at the university in order to support the practical activities are also briefly discussed.

Keywords: engineering skills; practical

1. Introduction

Beside academic achievements, engineering students need to have the extra valuable skills such as hands-on practical skills on everything that is heavily related to their scope of work later on. There are studies which show that the implemented curriculum normally provided little hands-on experience for the engineering students [1]. Industries or the market where these graduate engineers are going need an engineer that can do work immediately without having to undergo a series of training for a certain period of time. For example, the ability to handle or operate the massive mechanical machines for the mechanical engineers would be advantageous, although it is not necessary for the engineers who operate the machines in industry. The knowledge and hands-on experience of operating the machines that they have gained during their undergraduate training make them familiar with the machines. This saves time as no training is required for this fresh engineer on the specification and the operation of the machines. Another example is that the learning, understanding and the capability to use the Computer Aided Design (CAD) software will not be too long for the engineers who have already used the software during their undergraduate. Training benefits the engineers themselves and the institution that employ them.

This is basically the main reason for the introduction of the engineering skills courses in the engineering curriculum here at UniMAP. The courses are Engineering Skills I which is offered to the first year students and Engineering Skills II which is for the second year students. Both of the courses are graded and the units given are takes into account for graduation. As the courses have been categorized as the university's core courses, all of the electronic-based, electrical-based and mechanical-based engineering students must take and pass these courses while studying at this university.

2. Outcome-Based Education (OBE) issue

Nowadays, the engineering programs implemented by the academic institution are more focused on the outcomes of the program through the educational process known as Outcome-Based Education. There is basically a list of expectation of what the engineering graduates are able to do and the quality that they have developed after their studies. Therefore, the skills to be acquired by all of the engineering students must also satisfy the outcomes of the program. Among the Program Outcomes (PO) used in UniMAP that reflects the importance of hands-on engineering skills are as follows:

- ability to apply knowledge of basic sciences and engineering fundamentals
- ability to use techniques, skills, and modern engineering tools necessary for engineering practice so as to be easily adaptable industrial needs.

These POs must be substantively met by the engineering skills courses, Engineering Skills I and II, through their Course Outcomes (CO) which is designed such that this can be a platform for the students to develop the specified engineering skills. Of course when the courses are implemented, there are other POs or requirements of the engineering program that are also met and these are not limited to the list stated above.

3. The engineering skills courses

As described earlier, the Engineering Skills I and Engineering Skills II are core courses in the university's engineering curriculum. It is offered by UniMAP Engineering Center, which is one of the university's academic support centres. The code of the courses is ECT100/3 for Engineering Skills I and ECT200/3 for Engineering Skills II. Each of the course contribute 3 units to the total units required the graduation which is 135 units. The university's academic system specifies that with three units for each subject, the students are required to spend six hours per week in the laboratory or workshop session doing practicals. To comply with the system, the laboratory and workshop sessions are divided into two sessions per week involving three hours of spending time per session for students. There are no lecture sessions in both of the courses.

Since the introduction of both courses in the academic session of 2002/2003, the laboratory module for each subject have been developed and continuously improved. The module contains the basic description of the skills that the students will acquire during the session and the experiments sheet which explains the methodology and steps in conducting the practical. Every laboratory experiments and workshop sessions that make up the modules are designed to meet the objectives and outcomes of both the courses. The issues of regulations, standard and health and safety have also been taken into account when designing the experiments and workshop activities listed in the modules for the students. The students are then required to bring the correct experiment sheets for the module when attending the practical session.

The assessments for both of the courses are 100% on the coursework. Practical (laboratory and workshop) sessions contribute 60% of the total marks and the remaining 40% come from the evaluation of the group projects given. The group projects may consume up to 15 hours of the total 84 hours laboratory session per semester. The evaluation and assessments is done by Pegawai Latihan Vokasional (PLV) during laboratory or workshop sessions and they are also responsible for evaluating the group projects.

3.1. Engineering Skills I

For this first year course, the outcomes are listed as follows;

- Understand how to use AutoCAD 2002 software package.
- Ability to produce 2-dimensional and 3-dimensional engineering drawing using AutoCAD 2002.
- Understand how to use MATLAB software package.
- Ability to use MATLAB programming to solve engineering related problem.
- Ability to use basic tools of technical drawing and produce simple drawing.
- Ability to use mechanical measurements tools and do measurements.
- Ability to handle specific machines and use hand tools for shaping metals and do sheet metal forming process.
- Ability to use fitting tools and do fitting process.
- Understand the welding techniques and able to do arc and gas welding.

In order to achieve the course outcomes listed above, the Engineering Skills I is divided into four modules which consists of the following topics of syllabus and experiments as follows;

- AutoCAD 2002 software module
  - Introduction
  - Drawing and Editing
  - Layer Control & Properties Modification
  - Hatching and Dimensioning
  - Text & Template Drawing
- Technical Drawing module
  - Introduction
  - Geometric construction
  - Lettering
  - Tolerance
  - Sectional view
  - Symbols
- MATLAB Software Module
  - Introduction
  - M-Files
  - Projection Format
  - Matrix, Vector, Scalar
  - Plotting
- Mechanical Workshop Module
  - Introduction to measurement technique and measurement tools
  - Arc Welding
  - Gas Welding
  - Fitting process
  - Sheet metal process

Table 1 presents the contents of the Engineering Skills I courses including the total hours of laboratory or workshop session for each sub-topic and also the weight of marks given for each of them. These details are taken from [2] and it is applied to the 2006/2007 academic session.

Table 1. Engineering Skills I; sub-topics, hours per topic and the contribution of marks

Sub-topic	Hours	Marks (%)		
		Practical	Project	Total
AutoCAD software package	18	15	10	25
MATLAB software package	18	25	-	25
Technical Drawing	18	17.5	7.5	25
Measurements Technique	3	-	-	-
Fitting	3	0.625	5.625	6.25
Sheet Metal	3	0.625	5.625	6.25
Arc Welding	3	0.625	5.625	6.25
Gas Welding	3	0.625	5.625	6.25
Group Projects	15	-	-	-
Total	84	60	40	100

3.2. Engineering Skills II

In Engineering Skills II, the course outcomes are listed as follows;

- Understand how to use OrCAD software package.
- Ability to use OrCAD software package to produce schematic and layout of circuits design.
- Understand the Printed Circuit Board (PCB) fabrication process.
- Ability to fabricate PCB.
- Understand the technique and regulations of domestic electrical wiring.
- Ability to do installation of domestic electrical wiring.
- Understand mechanical machining and able to handle mechanical machines.
- Understand the Programmable Logic Controller (PLC) and able to do its programming.

The courses are divided into four modules and are listed as follows. The details are available in [3];

- PCB Fabrication and Design Module
  - OrCAD Capture CIS software
  - OrCAD layout software
  - PCB fabrication process
- Electrical Domestic Wiring Module
  - Electrical wiring regulation
  - Wiring system design
  - Distribution of supplies in buildings
  - Design and arrangement of final circuits
  - Conduit systems
  - Earthing
  - Inspection and testing
- Introduction to basic mechanical machining
  - Lathe Machine
  - Milling Machine
- Programmable Logic Controller (PLC) module
  - Structure of PLC
  - PLC Programming
  - Application

Table 2 tabulates the contents of Engineering Skills II with the corresponding laboratory hours and marks.

Table 2. Engineering Skills II; sub-topics, hours per topic and the contribution of marks

Sub-topic	Hours	Marks (%)		
		Practical	Project	Total
OrCAD software package	18	12	8	20
PCB Fabrication	3	1.5	3.5	5
Electrical Domestic Wiring	18	15	15	30
PLC	18	30	-	30
Lathe Machine	6	0.75	6.75	7.5
Milling Machine	6	0.75	6.75	7.5
Group Projects	15	-	-	-
Total	84	60	40	100

3.3. Facilities

The facilities housed at UniMAP Engineering Center consist of a number of laboratories and workshops providing sufficient support to the courses offered which is Engineering Skills I and Engineering Skills II. Furthermore the same laboratories and workshops have also been used by other courses and for purposes such as research and development activities without interrupting the schedule of both courses discussed here.

Table 3 lists the facilities available corresponding to the course's modules and the maximum number of students that it can accommodate per session.

Table 3. Facilities available, corresponding modules and the capacity per session.

Laboratory/ Workshop	Quantity	Module	Capacity (students)
Sheet Metal and Fitting	10 bench	Mechanical Workshop	40
Milling Machine	10 unit	Introduction to basic mechanical machining	20
Lathe Machine	10 unit	Introduction to basic mechanical machining	20
Arc Welding	20 station	Mechanical Workshop	20
Gas Welding	20 station	Mechanical Workshop	20
Electrical Domestic Wiring	40 wiring bay	Electrical Domestic Wiring	80
PCB Fabrication Laboratory	-	PCB Fabrication and Design	30

Table 3. Facilities available, corresponding modules and the capacity per session…(cont.)

CAD/CAM Laboratory	120 station	AutoCAD 2002 software MATLAB Software PCB Fabrication and Design	120
PLC Laboratory	40 set	Programmable Logic Controller (PLC)	80
Drawing Studio	120 station	Technical Drawing	120

From Table 3, it can be seen that the equipments or workspace is provided to the students within individual perspective and if sharing is needed it will be only for two students. This will give students more control and enhance their experience in performing the practical and thus increase their skills. For PCB Fabrication Laboratory, there is a complete set of equipments available to do the fabrication processes and the students will individually learn and do the processes. Notice that for sheet metal and fitting, there are four students that share the same bench at the same time. This is because the bench has a double ended equipment setup, which means that only two students are sharing at the same time. Considering the increase in the number of students, the facilities is fully utilize since the both of the courses Engineering Skills I and Engineering Skills II are offered every semester throughout the academic calendar. This makes the millions of investments worthwhile.

3.4. Implementation

The implementation of the courses is somehow critically limited by the factor of time and space during the semester. Imagine putting 450 students per laboratory session for either of the courses into the facilities that we have discussed earlier. The plan to have as minimum number of students as possible (in our case, the target number is one) per workstation or equipments in the laboratory or workshop is impossible. This problem is overcome by a carefully designed schedule whereby instead of putting every student to do the module in series, the batch of students is divided into small groups of 20 students and which will be given a group alphabet as an identification. Some of the groups will do different module while others do them at the same time. In other words, the group of students is rotated across every module that they have to complete. Fig. 1 is an example of the schedule for Engineering Skills I.

As can be seen from Fig. 1, taking the example of group E where it has been hightlighted in the figure, this group will do technical drawing module for the first six session of the semester with group F, G and H but the other groups will do the different modules. After finishing the technical drawing module, group E will then do the AutoCAD module and this rotation will go on throughout the whole semester. If no session is indicated for the group, for example second session of week six for group E, this available time is for students to do their projects.

Week	Technical Drawing	MATLAB	AutoCAD	Measurements technique	Fitting	Sheet metal	Arc Welding	Gas Welding
1	Course Briefing							
	EFGH	IJKL	MNOP	ABCD				
2	**E**FGH	IJKL	MNOP		A	B	C	D
	EFGH	IJKL	MNOP		B	A	D	C
3	**E**FGH	IJKL	MNOP		C	D	A	B
	EFGH	IJKL	MNOP		D	C	B	A
4	**E**FGH	IJKL	MNOP					
	ABCD	MNOP	**E**FGH	IJKL				
5	ABCD	MNOP	**E**FGH		I	J	K	L
	ABCD	MNOP	**E**FGH		J	I	L	K
6	ABCD	MNOP	**E**FGH		K	L	I	J
7	ABCD	MNOP	**E**FGH		L	K	J	I
	ABCD	MNOP	**E**FGH					
8	MNOP	ABCD	IJKL	**E**FGH				
9	MNOP	ABCD	IJKL		**E**	F	G	H
	MNOP	ABCD	IJKL		F	**E**	H	G
10	MNOP	ABCD	IJKL		G	H	**E**	F
	MNOP	ABCD	IJKL		H	G	F	**E**
11	MNOP	ABCD	IJKL					
	IJKL	**E**FGH	ABCD	MNOP				
12	IJKL	**E**FGH	ABCD		M	N	O	P
	IJKL	**E**FGH	ABCD		P	M	N	O
13	IJKL	**E**FGH	ABCD		O	P	M	N
	IJKL	**E**FGH	ABCD		N	O	P	M
14	IJKL	**E**FGH	ABCD					

Fig. 1. Example of Engineering Skills I schedule

3.5. Advantages and experiences to students

Based on the contents of both courses presented earlier, we believe that they cover most of the components needed to equip the graduates with the appropriate engineering skills. Hands-on laboratory experiences that the students have gone through during laboratory and workshop sessions on every sub-topics in the courses provide them with very useful knowledge. For example, students are able to develop data recording and analysis skills from Engineering Skills I components of measurements technique. They will continually use the technique whenever they have found a similar problem where measurement is needed in other courses or situation. Familiarizing students with software packages such as AutoCAD, MATLAB and OrCAD where these packages are very essential when it comes to the mechanical design or electronic circuit design and development during their undergraduate or even useful for them after graduation. During their final year when doing their final year project, the students are already familiar with the PCB fabrication process, milling and lathe machines. Electronics based students will find the design and development of electronics circuits or system for their final year project is within their capabilities. Students get familiar with the correct technique of handling mechanical machines and welding. This will also bring the knowledge of health and safety issue to mind of the students as they need to work safely. The same technical judgments are also applied when the students are doing the sheet metal and fitting projects. Electrical domestic wiring not only give students the essential technique to do wiring but also encourage them to be professional as they have to practice and understand the specific standard in domestic wiring. Essential communications and interpersonal skills are also building up in students as they have to works in group as well as writing reports for their project. Based on [4], the aim of the practical session in engineering is fulfilled by going through both of the courses.

4. Conclusion

The courses like Engineering Skills I and II will provide huge benefits to UniMAP engineering students. Students will not only have the strong background of theoretical from other lecture based courses but also have acceptable engineering skills. As the students have been put to the market after graduation or even during their studies, the components of the courses give them advantages and valuable experiences that can assist them in the engineering field. We believe that both of the courses fulfilled the target content of laboratory, workshop and practical session of engineering program. Of course there will be continuous developments to the courses contents to cover most of the engineering field as possible where it can be seen here that since its introduction, the course's content are more towards mechanical, manufacturing, electrical and electronic engineering.

References

1. F. Costanzo and G. L. Gray, On the Implementation of Interactive Dynamics, International Journal of Engineering Education, Vol. 6, No. 5, pp. 385-393, 2000.
2. ECT100/3 Engineering Skills I, Laboratory Manual, Pusat Kejuruteraan UniMAP, 2006.
3. ECT200/3 Engineering Skills II, Laboratory Manual, Pusat Kejuruteraan UniMAP, 2006.
4. I. Moore, Why Do We Have Practicals Anyway? – A Focus On The Essential Engineering Skills, Engineering Education in the Twenty-First Century (Digest No: 1996/105), IEE Colloquium on, pp. 52, 1996.

Infusion of Integrated Skills in the Professional Practice Course

Yasser A. Balila [a]

[a] Professor of Architecture, King Abdulaziz University, Saudi Arabia

Abstract

Architecture and engineering education should prepare students for the real practical life after graduation. One of the major courses supposes to fill gaps between academic life and practical experience is the professional practice course. It supposes to cover certain subjects and materials according to the course description, which included rules, regulations, ethics, communication skills, public relations, marketing, financial, legal issues and career options. But can we modify the content to acquaint students with adequate skills and expertise to fulfill their needs for a bread-and-butter life? Do we need to tailor the curriculum to accommodate different professional rules and cultures of each country? Can we assign term projects and other activities that will reinforce the goals of the course? The aim is to familiarize students whom practicing design in Saudi Arabia or alike of information and skills they need in their career, and from different aspects; governmental, professional, marketing, communication skills and opportunities they may raise after graduation. These are the goals and questions the researcher tries to answer through his practical experience of teaching and development the course for male (architecture) and female students (interior design). The development relied on personal experience, similar courses taught in some other universities, and typical course contents of some international schools. The discussion and result will be supported by a questionnaire distributed among students to get their evaluation and feedback as well.

Keywords: architecture; professional practice; interior design; course content; practical skills

1. Introduction

The core of higher education is to prepare students for practical life, in terms of scientific aspects, cultural, ethics and professional practical for each specialization. Of course for engineering profession as environmental design (architecture, planning, landscape architecture, interior design) those aspects should have more emphasis on because the direct relation with the life and safety of human being (similar to medical specializations).

The new trends of education “engineering, architecture” are going toward the development of thinking skills for students, intrapersonal development and their potential power to learn and self growing. Mainly there are five factors to be fulfilled for those whom are looking for success and uniqueness in practical life:

1. Scientific strength – research, theory… etc.
2. Applied / Practical skills – dealing with new thoughts, and high technology.
3. Sense of entrepreneurship / commercial – understanding numbers and financial concepts
4. Futuristic thoughts – ability to deal with engineering aspects for new generations, sustainability.
5. Dealing / communication skills – leadership, argument, negotiation, open mind [1, 2].

If we narrow the broadband above to get it down for each course and subject, the skills and attitudes, motivation, interaction of students with the curriculum, or content of the course may differ according to the nature of the subject and human response of each student. Nevertheless, each course in the curriculum usually contains the course description, the goals of the course, the content, prediction of the outcome (expected), reference book/s, and supported references. Consequently, the instructor of the course accommodates these contents in the time frame available for the course, to fulfill the objectives, goals and infuse his experience together with the flavor of his own character.

Now, the discussion will be very specific about the professional practice course, which has been part of almost all architectural programs. All courses should prepare students in one way or another for practical life after graduation. But this course in specific should shed some light on the explanation of the profession, some history background, commercial aspects, team working, consultation, solving disputes, management and leadership, job description, legal liabilities, design contracts, marketing and public relation and how to choose different careers? [3]. Professional practice could be described as Segal said: what architects should know to protect their designs, from concept through completion [4]. This could lead us to ask what a profession is? From the latter reference, a profession:

a. involves a store of knowledge that is more than ordinarily complex;
b. is an intellectual enterprise;
c. applies theoretical and complete knowledge to the solution of human and social problems;
d. strives to add to and improve the stock of knowledge;
e. passes its knowledge to novice generation, usually through universities;
f. tends to organize in peer formations that establish criteria for admission, practice, and conduct.

You as a teacher of the course have to prepare students to deal with parties in the construction industry; owners/clients (private and public clients), design professionals, engineers : structural, mechanical, electrical, other design consultants: lighting, acoustics, constructors, related fields, finance, marketing, sales, governmental officials, construction industry organizations such as the American Institute of Architects (AIA), Professional Engineers (PEs), the American Planning association (APA), the American Society of Landscape Architects (ASLA).

2. Professional Practice Model

It is advisable – while talking about the professional practice course - to have a general thought about the content of the course; whether at national or an international level. The ARC – 426 Professional Practice course from Architecture Department, King Fahad University of Petroleum & Minerals, Saudi Arabia introduces the knowledge required for a successful career in architectural practice and employment. The three parts of the course are: training and role in society of architects, organization and management of architectural firms and project administration. The course highlights practices in Saudi Arabia and compares with international practices [5].

The Arch 4315 course from the College of Architecture, Georgia Tech University, USA, offers the principles and framework of professional practice including ethics, legal climate, business practices and contracts, project process and management, office organization, and methods of building productions [6]. On similar basis the professional practice course offered by architecture program, Faculty of the Built Environment from The University of New South Wales, Sydney, Australia [7]. All those courses are similar to some extent in the content, the difference could be the way they are taught, weight of each part of the content and how the instructor uses his ways of teaching and learning to integrate all these skills and knowledge to his/her students.

3. The Developed Model

The concept of developing the professional practice course stems from several factors: the researcher teaching the course for many years, his experience of the architecture and engineering education {part time consultant for a private college of engineering and IT in Saudi Arabia}, practical experience in the local market, participation in many conferences and workshops related to the subject, and from the globalization phenomenon which reflects on the professional practice and all consultancy jobs.

The course development concentrated on different aspects related to the contents and the quality of teaching, which could be summarized as follows: the content, the instructor, course activities, term project, and real interaction.

3.1. The Content

The whole content of the course been revised by the researcher after participating in a workshop about management of training programs [8]. There was a part about "art of writing". It tells you if you would like to write about any subject, you have to go through 30-50 related references, you have to have a clear reasoning for writing, specify the target of your writing (transfer the knowledge, develop a skill, change a behavior or satisfaction). Do plan a mind map for the subject, transfer that to an index (table of content) applying the law 3 to 5 (3-5 chapters, sections, subsections… and so on) until you finish writing the material, spend a good time on that because it will relief you later when writing these sections. The researcher has ended up with a table of content for the course, divided into 14 weeks to cover the subjects been realized as important to cover according to their judging weights.

3.2. The Instructor

The instructor should keep himself up to date in the field of specialization what ever the subject is, that includes theory (reading the books, journals and from the internet) practical market (national & international), legal aspects, governmental authorities and private sectors. On the other hand, the teacher must attend workshops and training programs in general skills and especially in teaching, evaluation of students, coaching, preparation of exams, active learning … etc. In fact King Abdulaziz University in Jeddah, SA has arranged so many programs on the above subjects under the supervision of center for teaching and learning development (Innovation and Unique Training Programs) [9]. Also during the teaching, instructor is advised to treat the students in his classroom as trainees in a workshop, applying some rules of training programs [10]. These, as well as some new trends in teaching are being utilized through the term, like active learning, classroom assessment … etc.

3.3. Course Activities

All course activities been circled around the goals of the course, home works, classroom activities, discussions … From the beginning of the course each student was started by writing a paragraph on how to see himself in 3, 5 and 10 years time after graduation [11]. That assignment has opened a large debate among students of their future career and what are the opportunities available. Another example was for each student to present his curriculum vitae instead of the final exam, and each student should be asked to write a professinal CV, together with models/certificates of his/her works before graduation and during his life [12]. The thinking based learning has been infused in some lessons [13]. It was really a good experience doing of the skills (the decision making skill) on how to choose a type of contract with a client or a contractor or a consultant.

3.4. Term Project

In order to learn what the professional practice is in real life, each group of students (between 3 and 4) was asked to write a short report on one of the topics related to the subject. Fifteen topics were given to the students to select from them to acknowledge the life in real practice. The outcome and reports presented by students were just excellent trials to know even how you can practice in future and requirements for starting your own office. Interviews are being made by the students, questionnaires, videos and photographs, some quotations, descriptions … etc, from the private or public sectors are all being documented.

3.5. Real Interaction

To complete the picture of interaction of students with professional practice, it was planned to invite one person or two during the term with a good reputation in the field, to talk about his/her experience with students. Graduates from the same school were given preference. This was a good experience from the point of view of starting their own businesses and recognizing challenges they could face after graduation. It will be much better to invite more than one person with different experience (length, kind, size and form). Ask your students to prepare before and whatever questions they have in their field, and later ask them as a homework to summarize main points in not more than one A4 size sheet.

4. The Questionnaire

4.1. Questionnaire

One of the strategies for evaluation and development of a course is the questionnaire principle. The researcher has distributed a one page questionnaire among students to analyze and assess the course as a whole and to evaluate certain aspects after the development model mentioned above. The questionnaire contained four parts: first part of questionnaire was general information - number of courses the students registered credit hours been completed and his GPA. Second part was about teaching and learning. Among 21 short questions, some were to evaluate the interaction of students with the course, the instructor encouraged students to interact, pulled students attention to the subject, the development of thinking and creative skills and outside readings. The third part was about the course, how difficult the content was. The last part was if the student has any suggestions to develop teaching this course in the future.

The questionnaire has been distributed among 83 students, 51 from architecture department (male) and 32 from interior design (female) and 57 were returned and analyzed. For the second and third parts of the questionnaire, a ranking point was given from 1 (lowest) to 5 (highest). After classifying the points from the questionnaire, the results system were transferred to percentages of 100% to give an indication of certain questions related to the subject and research.

4.2. Results

Although it was not a big sample test to get solid results out of the questionnaire, the analysis would give an indication of existing situation and future development. Six questions were chosen from the questionnaire which has a relation with the study: for example - the presentation of scientific content in an organizational way, 30% marked scale 4 (very good), 65% marked scale 5 (excellent), and so on. Table number 1 will summarize the results in percentages.

With slight differences, one can read the outcome of the course from the first five questions, where most of positive percentage indications been seen (scales 4 & 5). From question number 6, it seems there is a variation in the opinions of students about how tough the course was? However 67% of students mentioned it was middle and below (scales 1, 2 & 3). Nevertheless, more detailed analysis should be done to verify which part/s of the course was/were most difficult, and how it can be tackled in future.

Table 1. Results summary of the questionnaire (in %)

S #	Element	1	2	3	4	5
1	The course presented in an organized methodology	5 %	0%	2%	30 %	63 %
2	The instructor encourage students to participate in the classroom	5 %	0%	2%	11 %	82 %
3	Upgrade students interest & attitude	4 %	2%	5%	19 %	70 %
4	Easiness in transfer of information	4 %	2%	5%	23 %	66 %
5	Growth of thinking and creativity, reading	2 %	5%	4%	21 %	68 %
6	Range of difficulties in course content	12 %	23 %	32 %	19 %	14 %

4.3. Comments

The last part of the questionnaire was about suggestions from the students for future development of the course in general, and a few good comments been chosen. The comments varied from - meeting architectural engineers in the construction sites, visiting consulting offices, more development toward practical side (field trips, seminars, workshops, related to the course), to emphasis more on visiting institutional bodies and organizations, initiate a website to communicate and discuss related topics of those who are interested, or interrelate the requested training with the course to reinforce the theoretical side and make it more touchable, divide the course so there is an applied part to revise the course material on reality, listen to outside opinions about graduated students from the owners of consulting offices.

5. Discussion

So many skills, attitudes and disciplines are needed to be integrated and infused into the curriculum to train students for practical life. One of those courses is the professional practice course, which the researcher tried his best to accommodate important skills and knowledge in allocated time and credit hours of the course. The letter was not enough to accommodate all skills, so been selected and fill with what is possible, and taught in the way described before.

Globalization should be taken into consideration. Although students should be aware of what is going on in the local market (consultation and professional practice), they have also to know consultation and practice in the international market and the implications of World Trade Organization on professional practice. You have to think locally but plan to work globally in the future. So many aspects have been mentioned to develop the course (or any course as well), but you as an instructor play the major role in the methodology. At the end, your character and ambition to develop the course and upgrade your students will shed light on the process. In other words put your finger tips on the course. You as an instructor have to know the students' weaknesses from your evaluation and from people employing your graduates, so you can integrate required skills into the course as much as time available. The questionnaire has shown positive signs of students' interaction with the course, although the content seems a little bit tough, it should be reevaluated in the future. What if you as an instructor try to conduct the course as a coach or a facilitator rather than “a full time speaker” for some lectures only? Let the students talk and discuss more with you and with themselves. Infuse some thinking skills, interactive learning and stimulate them by discussing one of the debating issue of the subject in the classroom. Our students have a lot to say and argue about, to express their attitudes and feelings, but sometimes we under estimated their potentials and powers!

6. Recommendations

One of the important courses for architects and engineers is the professional practice course. With slight differences between different schools offering the course, but for architects is how to transfer your ideas and designs into buildings and how to protect them in terms of professional organizational, legal and ethical aspects. Usually the course will not be enough to infuse all skills the students needed after graduation, but as an instructor:

1. Coordinate with other instructors in your school of how you can cover all or most of skills needed.
2. Focus all activities and assignments around fulfillment of the goals and target of the course.
3. Students should get a reasonable dose of professional practice on international scale, and what are the impacts of institutional organizations on the profession.
4. Stimulate the students' participation and interaction. They own great attitudes and motivations if they find a big ear listening to them.
5. The development of yourself is a crucial part of teaching and learning processes. It is an open ended area. Plan, participate and focus on activities that will enhance your character and

skills. "You were born an original. Don't die a copy" - John Mason.

Acknowledgements

The researcher would like to express his gratitude to King Abdulaziz University, Saudi Arabia for their support to participate in the RCEE 2007 conference. Also Center of Teaching and Learning Development, KAU for the organization of quality workshops and seminars.

References

1. A. Jomaa, Engineering Education in 2020; Satisfying Industrial Needs, King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia, 2006.
2. Y. Balila, What Are Adequate Higher Education Prototypes in New Economic Cities in Saudi Arabia, Saudi New Towns, Visions & Ambitions, Saudi Urbanism Forum – Riyadh, SA, 2007.
3. Undergraduate Bulletin, King Abdulaziz University, Jeddah, SA.
4. P. Segal, Professional Practice: A Guide to Turning Designs into Buildings, W.W. Norton & company, Inc., New York, 2006.
5. Undergraduate Bulletin, King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia, 2006 – 09.
6. Website of Georgia Tech University, http://www.coa.gatech.edu/arch/courses/4000/arch4315.php.
7. Website of the University of New South Wales, Sydney, Australia: http://www.handbook.unsw.edu.au/undergraduate/courses/2007/ARCH1582.html.
8. T. Sweedan, Conducting Training Programs and Training the Trainers, King Abdulaziz University, 2007.
9. Website of Quality Programs for Faculty Development, KAU, SA: http://www.kau.edu.sa/administration/vpdev/fdp/indexar.asp.
10. C. Sherer, Train Trainers; Oxford Academy, Jeddah, SA, 2007.
11. J. Lees, How to get a Job You'll Love, McGraw Hill Int'l (2002, U.K). Authorized Translation by A. AlAmry. Obeikan, S.A, 2006.
12. S. AlMasaudi, Communication Skills, King Abdulaziz University Publications, S.A, 2006.
13. A. L. Costa, Developing Minds: A Resource Book for Teaching. Thinking, Association for Supervision and Curriculum Development (ASCD), Alexandria, VA, USA, 3rd ed., 2001.

Innovative Delivery via Integrated Project

M.S. Takriff, S.R.S. Abdullah and N. Tan Kofli

Department of Chemical and Process Engineering
Universiti Kebangsaan Malaysia
43600, Bangi, Selangor, Malaysia
sobri@eng.ukm.mya

Abstract

Feedback gathered from students for the past few academic years at the Department of Chemical and Process engineering, Universiti Kebangsaan Malaysia indicated that there was lack of integration in the delivery of chemical engineering curriculum and students were overburdened with too many projects at a given semester. An innovative delivery approach via integrated project was formulated and implemented to address the concerns raised by the students. This paper discusses the formulation and implementation of the integrated project. Implementation of the integrated project successfully relate and reinforce the various chemical engineering subjects to the overall chemical curriculum and provide excellent opportunities for development of soft skills such as team work, independent learning and communication.

Keywords: innovative delivery; integration; chemical engineering curriculum

1. Introduction

In an effort to improve the quality of its academic program, the Chemical and Process Engineering department at the Universiti Kebangsaan Malaysia (UKM), has actively seeking feedbacks from the students. Among methods that have been utilized in getting feedbacks from the students are by holding dialog with students representative and conducting exit survey on the graduating class towards the end of their final semester. The objective of the dialog and survey are to obtain feedback on the learning process that the students have gone through in the department. The survey was conducted for the first time in the 2004-2005 academic years while the dialog was started in the 2006-2007 academic years

The results of the dialogs and surveys that were conducted indicate common concerns that were raised by the students. Among the more significant concerns raised by the students are lack of integration in the delivery of the chemical engineering curriculum. Each course focused only on its scope and no effort was made to relate the subject matters on a given course with the other courses in the same or previous semesters. Students were overloaded with a number of projects in a given semester. Every semester almost all courses that the students enrolled have significant project components, thus the students did not have enough time to prepare good reports for all the projects.

The only exception where students were required to integrate the knowledge that they have learned is the plant design course in the final semester of the 4 years chemical and biochemical engineering programs. Reflecting on the students' feedbacks and the existing delivery approach, the department's members agreed that the students raised valid concerns and an innovative delivery technique is required to improve the curriculum delivery. Thus, this paper highlights the integrated delivery approach that was formulated and implemented in the department beginning in 2006-2007 academic years.

2. Integrated Delivery

The integrated delivery was achieved via an open ended integrated project for all chemical engineering courses in a given semester. This section elaborates the components of the integrated project, its implementation and assessment technique. As highlighted in the introduction, the two main concerns raised by the students are lack of integration and overburdened by the number of projects that need to be completed in a given semester

2.1.Objectives of Integrated Project

The integrated project was formulated to address the concerns raised by the students and soft skills development such as communication, teamwork and independent learning. The specific objectives of the integrated project are:

i. Integration aspects of different courses in chemical engineering curriculum

ii. Application of basic knowledge and theories obtained from lectures in a project.
iii. Project work that satisfies (i) and at the same time does not overburden the students.

2.2. Components of the integrated project

The integrated project was implemented for the first time to the second year students in the in the first semester of 2006-2007 academic year. An integrated project covering wide range of topics from material and energy balances, thermodynamics and physical chemistry was formulated to ensure that the students were provided with an opportunity to apply the chemical engineering knowledge that they have learned and at the same time do not overburden them with too many projects. The details of the project scope and elements for semester 1 second year courses are presented in Table 1. The elements of the courses in the 1st semester such as property estimation (Chemical Engineering Thermodynamics), energy and mass balances (Chemical Process Principles) were included in the project scope in the second semester. The details of the project scope and elements for semester 2 second year courses are presented in Table 2.

The integrated project provides an excellent opportunity for students to develop their soft skill such as communication and team work. For communication, the integrated project requires both written and oral communication. The students were required to present their findings orally and written communication was in the form of technical report and minutes of group meetings. To encourage independent or active learning, the last four weeks the students completed the integrated project with minimum supervision from the lecturers. The students planned for their group meetings and search the required materials in the library or the internet on their own initiatives. The department's lecturers were always available for consultation. In addition, the integrated project required students to use professional simulation software. This help to introduce the application of professional simulation software at the early stage as suggested by Mohamed and Takriff (2003). Students were provided with an overview lectures on the use of professional simulation software, and the necessary reference material for the software.

2.3. Implementation

The students were informed on the implementation of the integrated project on the first week of the semester. The students were divided into teams of four and the instructors decided on the team members as suggested by Oakley et al. (2004). Each group elected a team leader who was responsible to lead the team discussion and project implementation. The learning activities throughout the fourteen weeks semester cover both traditional lectures by the course instructors, industrial visit and industrial lecture for ten weeks and independent study by the students on the integrated project in the final four weeks. The traditional lectures for each course provide the necessary course syllabus coverage. However, the depths of topics that were covered by the project were kept to the basics. Students are expected to cover the necessary depth in the integrated project.

Table 1. Components of 2nd year integrated project Semester 1 2006-2007 Academic year

Components	Details
Courses enrolled in semester	Chemical Process Principles, Chemical Engineering Thermodynamics, Physical Chemistry for Engineers
General Components	Supply and demand scenario for the products, Uses of the products, Environmental issues on waste generation and discharge limits
Chemical Process Principles	Energy and Mass balance for a single components, Energy and Mass balance for multiple components
Chemical Engineering Thermodynamics	Property estimation, Vapour-liquid equilibrium calculations such as dew points, bubble points and flash estimations
Physical Chemistry for Engineers	Chemical and physical properties of components involved, basic chemical kinetics

Table 2. Component of 2nd year integrated project Semester II 2006-2007 Academic year

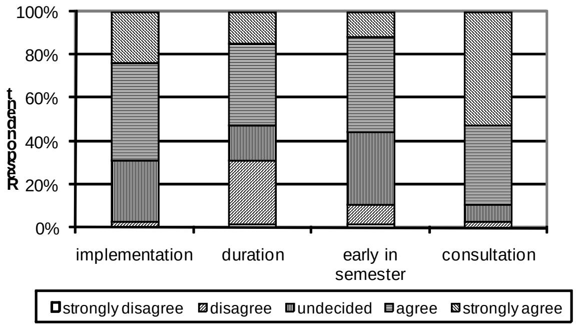
Components	Details
Courses enrolled in semester	Organic Chemistry, Transport Phenomena I, Chemical Engineering Reaction I
General Components	Raw materials and uses of products, Supply and demand scenario for the products, Determination of physical properties for chemicals, Heat and Mass Balance, Process Flow Diagram
Organic Chemistry	stoichiometric equation for the process, specify any by product of the process and identify separation method of this by product , indicate a way of stabilizing this monomers
Transport Phenomena I (Momentum transfer)	Application of Bernoulli principle to fluid flow system, Incompressible and compressible fluids, Fluid moving machinery (pump and compressor)
Chemical Engineering Reaction I	choice of reaction path, reactor selection, reaction kinetic and mole balance

Assessment on the integrated projects covers technical evaluation on the report that was submitted, oral presentations and peer assessment. The technical evaluation was carried out by the lecturers for the respective course or subject matter. The students were required to present an oral report on the project in the final week of the semester. The final form of assessment is peer assessment on the performance of each team members. Since the students spent the last four weeks in a 14 week-semester, the projects carried a 25% weightage of the final grade for each course.

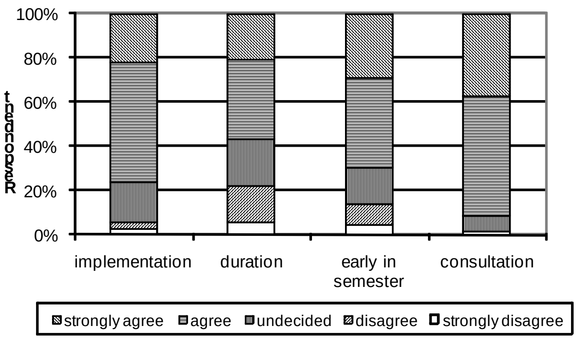
The students are required to submit their group report and present an oral report on the project in the last week of the semester in the presence of all the lecturers for the chemical engineering courses that the students enrolled in a particular semester. Students were provided feedback on their performance in completing the integrated project by the respective lecturers.

3. Results and discussion

A survey was conducted at the end of the semester in order to gauge the effectiveness of the delivery technique and to further improve its implementation. Fig. 1 shows students' views on the implementation 2006-2007 academic years. Based on the students' feedback, the implementation of the project for the first time in the 1st semester of 2006-2007 year required improvement. With the improvement that was incorporated, majority of the students agreed that the integrated project was implemented smoothly in the 2nd semester of 20062007 academic years. This figure shows that for both semesters, the majority of the students agreed that despites without formal lecture in the last four weeks of the semester, the lecturers are readily available for consultation and students are provided with adequate guidance to carry out the project. The results of the survey indicates that majority of the students agreed that handing over the project statement to the students at the beginning of the benefit the students. However, only slightly more than half of the students agreed that 4 weeks is adequate for completing the project. An improvement on the project scope was incorporated in the 2nd semester of the 2006-2007 academic years, but the students' opinion remains the same. The results imply either the open ended integrated project fails to address the issue related to the students being overburdened with project or the scope of the project was not communicated clearly to the students. A dialog session was conducted with student representatives to determine the reason for such a situation. Based on the dialog, that majority of the students misunderstood the scope of the open ended project and better communication on the scope of the project is required.



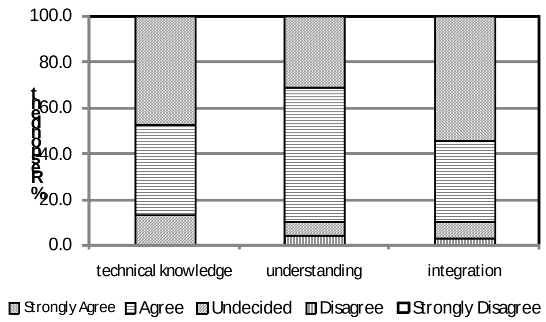
(a) Semester I



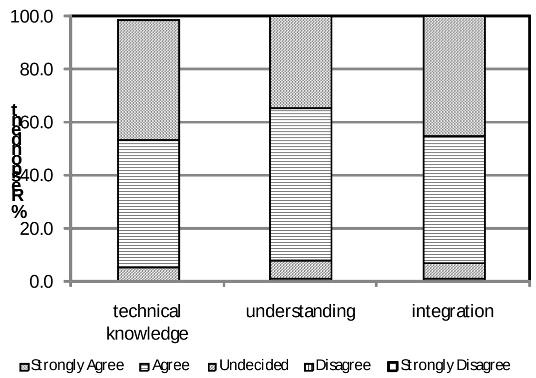
(b) Semester II

Fig. 1. Implementation of integrated project.

The integrated project is formulated to provide opportunities for the students to practice the technical knowledge that they have learned and to bring together the various aspects of chemical engineering courses to the overall engineering objectives. Fig. 2 shows students' feedbacks on these elements of the integrated project. More than 85 percent of the students in the first semester and 90 percent in the second semester agreed that the project successfully integrate the different aspects of chemical engineering courses. For opportunities of applying chemical engineering knowledge, 86 percent of the students in the first semester and 93 percent in the second semester agreed that the integrated project allows them to practice their technical knowledge and reinforces the various chemical engineering subjects to the overall chemical curriculum. Fig. 2 also shows that introduction and application professional simulation software helps to show relevance of the different subjects to the overall engineering objectives. The application of professional software help the students to have a better understanding of the lecture topics and appreciate the influence of operating parameters on chemical engineering unit operations. However, majority of the students felt that they were not provided with adequate exposure and instruction on the use of the professional software.



(a) Semester I



(b) Semester II

Fig. 2. Application of chemical engineering knowledge and integration of different courses.

UKM engaged two leading chemical engineering scholars from the University of Manchester, United Kingdom and Monash University, Australia to provide assessment on the biochemical and chemical engineering degree programs offered, respectively. Both of them had high regard for the integrated project. Webb (2007) stated in his assessment report that "the introduction, recently, of an Integrated Project to bring together aspects of several course units is a particularly innovative feature of the degree program. Student feedback since its introduction has been very positive and students appreciate the opportunity to reinforce what they have learned in several modules, while at the same time recognizing that it also helps with preparation for formal assessment. The marks awarded for the project serve as the coursework element for the relevant course modules". While, Rhodes (2006) considered it as a novel feature in the program and stated in his report that "some courses in a given semester are linked through integrated projects. Towards the end of the semester students' work in teams to tackle projects where the skills developed in individual courses are applied to a single project. The 2nd year student interviewed by the assessor reported that students found this approach to be very useful in showing the relevance of the different subjects to the overall engineering objectives".

4. Conclusion

The implementation of integrated project is an innovative delivery technique that successfully relates and reinforces the various chemical engineering subjects to the overall chemical curriculum. The integrated project was formulated in response to graduate and industry feedback and is an excellent example of how useful such feedback is. It has provided excellent opportunities for development of soft skills such as team work, independent learning, communication and etc among the students.

References

1. A.W. Mohmmad and M.S. Takriff, 2000, Using professional simulation software for better integration in the chemical engineering undergraduate curriculum, World Transaction on Engineering and Technology Education, 2(2): 321-324 (2003)
2. A.W. Mohamad, M.S.Takriff, and M.F. Basri, Integrating professional software in an undergraduate distillation course, Proc. Of the 4th UICEE Conference on Engineering. Education, Bangkok, Thailand: 284-286 (2001)
3. B. Oakley, R.M. Felder, R. Brent and I. Elhajj, turning student groups into effective teams, Journal of Student Centered Learning, 2(1): 9-34 (2004)
4. M. Rhodes, External Assessor Report, Chemical Engineering Program, Department of Chemical and Process Engineering, Universiti Kebangsaan Malaysia (2006)
5. C. Webb, External Assessor Report, Biochemical Engineering Program, Department of Chemical and Process Engineering, Universiti Kebangsaan Malaysia (2007).

Generating Social and Intellectual Capitals among Engineers in ICT Companies

Noradiva Hamzah, Rosmah Mat Isa

Faculty of Economics and Business
National University of Malaysia
43600 Bangi Selangor

Abstract

Intellectual capital is said to be a source of competitive advantage and there is evidence that business success can be partly explained by its intellectual capital. It is argued that the main dimensions of social capital of relevance to knowledge sharing are structural, cognitive, and relational capital because these, among other things, foster the exchange of knowledge and resources among the team members. The objective of this paper is to investigate the importance of social capital in fostering the development of intellectual capital among the engineers. This study used grounded theory method and data were collected through interviews. Data were analysed using open, axial and selective coding. The analysis shows that the most important dimension for intellectual capital development is structural capital. The most important, the findings also suggest that structural capital is a prerequisite of relational capital among engineers in an organizational project. The findings also demonstrate that frequent meetings and interactions, relationship, hierarchy or status, and shared language are among the factors that foster the sharing of knowledge among engineers. This study also elucidated that structural and relational capitals play important role in knowledge sharing and hence intellectual capital development.

Keywords: intellectual capital; social capital; relational capital; cognitive capital; structural capital; organisational capital; knowledge sharing, engineers

1. Introduction

The effective management of intellectual capital has been proposed as a critical element of organizational flexibility and innovation (Rockart, 1988 and Henderson, 1990). Therefore, organizations should learn to improve continuously and this could be carried out through innovation. According to Tushman and Nadler (1986), there are two types of innovations: product innovation and process innovation. Product innovation involves changes in product which an organization produces or the service it provides. Meanwhile, process innovation involves changes in the way a product is made or the service is provided.

It is believed that the most flexible and innovative organizations are those which have effective learning system and those which could maximize both their abilities to acquire information about their customers, competitors and technology, and their abilities to digest that information. Tushman and Nadler (1986) suggest three critical factors in managing innovation: informal organization, organizational arrangement and individual. These three critical factors are similar to the three dimensions of intellectual capital (people, external and internal) introduced by Bontis (1998); Sveiby (1997); Roos *et al.,* (1997) and Stewart (1997).

The people dimension incorporates competencies, knowledge, know-how and experience of the individuals in an organization. The internal dimension includes organization structures, routines, processes, and management systems. This also includes the norms and culture of an organization, and the systems and work processes; including information technology (IT), communication technologies, images, concepts, and models of how the business operate, databases, documents, patents, copyrights and other codified knowledge (Allee, 1998). Meanwhile, the external dimension is referred to the external constituencies and structures such as links to customers, suppliers and other stakeholders and networks (O'Regan, O'Donnell and Heffernan, 2001).

Organizational flexibility and innovation require the management of an organization to hire, develop, and train a set of individuals with diverse skills and abilities, and has the capacity to innovate. Strong individual specialization must be boosted by skills in problem solving, communication, conflict resolution, and team building. Therefore, it is a challenge for organizations to develop effective social networks throughout the organization (Nelson and Cooprider, 1996; Rockart, 1988; Reick and Benbasat, 2000).

The importance of social capital for organization survival has been proposed for over thirty years. Social capital is the goodwill built up with users, functional managers, corporate managers and outside parties (Reich and Kaarst-Brown, 2003). We argue that strong partnerships among engineers are a key piece of achieving competitive advantage.

2. A theoretical lens

In today economy, the essential apprehension of organizations is how to manage their intellectual capital (Teece, 2002; Nahapiet and Ghoshal, 1998). There is a significant and growing body of research suggesting that intellectual capital is associated with important outcomes and processes in the organizations (Nahapiet and Ghoshal, 1998; Meyer, 1994; Nohria and Eccles, 1992). Organizations must be positioned to anticipate in developing the needs of the customers and in responding to these needs through additional innovative products and services. Organizations do not have brains but they have cognitive systems and memories (O'Keefe, 2001). Furthermore, consumers nowadays are becoming more sophisticated in their selection of products and services, and they have wider choices in the market and expect new and improved products, superior services and lower prices.

There is no universally accepted definition of intellectual capital in the literature. However, most of the definitions and frameworks of intellectual capital include human, customers, suppliers, and organizations as factors (e.g. Roos and Roos, 1997; St Onge, 1996; Van Krogh and Roos, 1996). For the purpose of this study, three classifications of intellectual capital are used: relational capital, human capital and organizational capital. The term relational capital refers to external capital of organization and it includes relation with the suppliers, customers and other members of its external community. Human capital refers to the know-how, skills, capabilities, experiences and expertise of an organization's members. Human capital present in an organization but the organization has imperfect ownership of it. Human capital is used to accomplish tasks at hand and ultimately achieve organizational goals and missions (Youndt, Subramaniam and Snell, 1996). But this human capital can leave the organization. Organizational capital refers to the internal configurations and system of an organization. It consists of two components: innovation that includes intellectual property and intangible assets, and process capital that includes organizational structure and operating procedures (Roslender and Ficham, 2001). The organization has perfect ownership of its organizational capital (Roslender and Ficham, 2001; Sveiby, 2001).

3. Research Framework

Ulrich (1998) argues that intellectual capital has been conceptualized as a combination of competencies and the commitment to apply one's ability. Although intellectual capital has been characterized as an attitude of the individual (Simon, 1991), the dominant view is that it is an organization level construct (Brown and Duguid, 1991; Nelson and Winter, 1982). Nahapiet and Ghoshal's (1998) theory argue that the presence of social capital will facilitate the creation of intellectual capital and leading to organizational advantage. These can be achieved through two modes: combination and exchange (Nahapiet and Ghoshal, 1998). Combination refers to the act of combining knowledge in new ways, either incrementally or radically. Meanwhile, exchange refers to a transfer of explicit knowledge or tacit knowledge through teamwork or collaboration.

For the purpose of this study, we applied Nahapiet and Ghoshal's social capital theory to look intellectual capital development among the engineers. This study argues that the intellectual capital development among the engineers is highly influenced by their social capital. This study used three dimensions of social capital that create the value of the intellectual capital introduced by Nahapiet and Ghoshal (1998): structural, cognitive and relational.

The development of intellectual capital can be explained through social capital theory. Social capital can be defined as *the sum of the actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit* (Nahapiet and Ghoshal, 1998). Nahapiet and Ghoshal (1998) have delineated three dimensions of social capital: structural, relational, and cognitive capitals. Structural capital refers to the network structure or connection between the actors. It consists of the number of people in the network, their willingness to lend support and their willingness to do so. This relationship is very important as it can enhance both the firm and individual performance in two ways; first by facilitating access to information and resources, second by helping co-ordinate task interpedencies (Gargiulo and Benassi, 2000). Relational capital refers to the nature of the personal relationship such as trust, toleration, and cooperation that develops between specific people (Nahapiet and Ghoshal, 1998). Trust and relationship will lead to positive attitudes and behaviour among the workers (Sparrow and Cooper, 2003; Gambetta, 1988). According to this theory, workers have to be able to trust others to discharge their obligations. It is not only enabler to increase cooperation but also as catalyst to improve flexibility, lower cost or coordinating activities and increase level of knowledge transfer (Inkpen, 1998). Without trust and sense of reciprocal obligation, workers will be less committed and less loyal, which will lead to high turnover intention. Cognitive capital is defined as a degree to which actors of the network share a common understanding to the achievement of common goals and outcomes (Inkpen and Tsang, 2005). With the new kind of employment relationship, it circumvents individuals from having same frame of reference, which in turns hinder them to interact with one another successfully and hence, they are less likely to become partners in sharing and exchange their resources (Wasco and Faraj, 2005; Tsai and Ghoshal, 1998).

4. Research Objective

The objective of this study is to investigate the importance of social capital dimensions in intellectual capital development. It also tends to investigate factors that foster or hinder the development of intellectual capital among the engineers. ICT companies were chosen because this type of organization must continuously innovate in order to maintain its competitive position.

5. Research Methodology

In this study, engineers were chosen based on their involvement in an organizational project. Interviewing was used as the principle method of investigation. Nahapiet and Ghoshal's model (1998) informed the research, rather than asking direct questions about all the three dimensions under social capital, the respondents were asked questions that encourage them to speak openly about their opinions, views and experience. For instance, they were asked about their relationships with other team members, and the medium and frequency of interactions. Interviews were open and flexible and all were taped, transcribed and coded against the dimensions suggested by Nahapiet and Ghoshal (1998). To aid consistency, interview data was initially coded, based on the coding of social capital developed by us.

6. Findings and Discussion

6.1. Analysing the three dimensions of social capital and their relationship with intellectual capital

This study helps us understand the complex process in which outcome expectation of social capital affect (determine) intellectual capital development among engineers. The results indicate that social capital dimensions have a significant impact on the development of intellectual capital.

6.2. Structural social capital

The structural dimension of social capital refers to network structure or connection between actors (Nahapiet and Ghoshal, 1998). It consists of the number of people in the network and the way they gain knowledge to develop or gain access to intellectual capital. The data provide evidence that there were cross functional networks among the engineers as they were chosen from different departments and have diverse skills and knowledge. Formal activities carried out when working in a project (for example; meetings, presentations, briefings, and workshops) cultivate the opportunity for knowledge sharing among the team members. Hence, formal activities are perceived as a focal point connecting the team members.

Based on the interviews, meeting is seen as important because it creates the opportunity for the team members to share knowledge and hence developed their intellectual capital.

> *This project involved many people from other departments; sometimes I don't know some of them. I discovered that this meeting is useful for me as I know who is responsible for what, it makes it easier for me to ask the person concerned if problems occur.*

In line with the argument that network closure would be more likely to promote the sharing of resources (Nahapiet and Ghoshal, 1998; Coleman, 1990; Bourdieu, 1986), our findings suggest that in a project context, close network which is a result of organisation as institutional setting is important for the sharing of knowledge (Moran and Ghoshal, 1996). It can be posited that closure or density of the group is necessary realistic in a project context for example through formal interaction such as periodic meeting in which the leader seeks the input of employees, hence knowledge can be shared (Bartol and Srivastava, 2002).

Findings also suggest that previous interaction helps the engineers to have connection or relationship which can be transferred to another setting. It was also apparent that engineers had favoured to return to the team members who had behaved flexibly in the past.

> *I would say that it is much easier to work with somebody that you know or have been working together before rather than a total stranger…because you don't know what to expect.*
>
> *I find it easier to interact with the team members if we had worked together in the previous project. Furthermore, I will know better about their expertise.*
>
> *We went for a two weeks training together. I guess I know her much better than before. I am quite 'OK' with her compared to others.*

Consistent with the previous studies (Newell *et al.,* 2004; Koskinen *et al*., 2003), project members can use existing social capital that has been built up over time through previous involvement in other projects, job rotation or other relations such as training and workshop.

Findings from the interviews suggest that most of the knowledge sharing entailed a significant amount of face-to-face or at least telephone interaction. Researchers have confirmed that face-to-face meetings are the key driver for knowledge transfer and crystallisation of new ideas, and are the best method for the manifestation of alternative opinion (Swan *et al.*, 1999; Bennet and Gabriel, 1999). The finding from this study confirms that complex information is transmitted face-to-face in an office. In line with the media richness theory, preference for face-to-face interaction is due to a need for clarity, understand ability, facial expression and feedback. Media richness theory also argues that people use less Computer Mediated Communication (CMC) compared to face-to-face communication especially if the required knowledge is complex.

However, the findings from this study also suggest that apart from face-to-face interaction, the younger members aged 35 and less prefer to use CMC. We speculate that most of the young team members prefer to use e-mail and mobile phone.

> *I prefer to use text messages, I don't know…everybody use text messages…I find it convenient.*

In terms of position or hierarchy, findings from the interviews indicated that the interviewees internalised a feeling of vulnerability from the status they held in the project. Consistent with suggestion by De Long and Fahey (2000) that status differentiation can lead to 'silo mentality' which encourage employees to spend time defending their unit's perspective and an overall unwillingness to express ideas. Consequently, engineers accepted the prevailing norms of behaviour which emphasised status differences such as senior and junior. Status different among the engineers can also hamper their willingness to contribute their knowledge for the project. For example, they were suspicious of others looking at them as not competent or blaming them for failure that they had no chance of avoiding.

> *Sometimes, I feel afraid to talk because if I give suggestions, and it turns out to be unconstructive, people will put the blame on me.*

The findings are similar to Wasko and Faraj (2000) that individuals are less likely to contribute when they feel their expertise to be inadequate. On the other hand, by asking for help, an individual may fear looking incompetent and thus suffering a blow to his or her image (Edmonson, 1999). Brown (1990) contends that asking for help, admitting errors, and seeking feedback illustrate the kinds of behaviour that could pose a threat to face. In addition, the unwillingness to express one's ideas and knowledge for fear of being criticised also characterises an environment in which diversity of opinions and perspective is devalued or altogether not valued. Unfortunately, network structure properties such as hierarchy and status may hamper the development of intellectual capital (Nahapiet and Ghoshal, 1998)

6.3. Cognitive social capital

Cognitive capital refers to the shared representation and systems of meaning among parties. It enables the network actors to share a common understanding to the achievement of common goals and outcomes (Inkpen and Tsang, 2005). However, it requires the ongoing dialogue of shared meanings among parties. Cognitive effect of social capital on intellectual capital was fostered by the existence of a shared engineering culture and language (Karuna, 2004).

> *Some of the team members do not understand me, probably because of the jargon that I used. Only engineers will do.*

Similar to Karuna (2004), findings show that engineers developed and institutionalized their owned 'language' obstructing and complicating conversation with other team members. In line with our expectation, shared language has a significant impact on the intellectual capital development.

Furthermore, findings from the interviews also suggest that area of expertise inhibits the ability of the engineers to communicate beyond their boundaries and discipline. They are also reluctant to accept others' opinions and suggestions. Koruna (2004) mentioned that this is the engineers' syndrome who always rejected ideas from outside.

6.4. Relational social capital

Engineers could generate relational capital based on the resources and capabilities housed within the organisation. This finding seems to provide support to the argument that relationship may not be developed in organisational project context due to short term relationship, lack of shared history, infrequent interactions, lack of co location, and lack of co presence (Cohen and Prusak, 2001; Nahapiet and Ghoshal, 1998; Nohria and Eccles, 1992). Despite the lack of frequent interaction, engineers still share and disseminate knowledge when they are structurally embedded in a network. Surprisingly, engineers do not expect others to contribute, nor do they expect help in return.

Among the engineers, reciprocity norms were not important in governing relationship with other team members. Engineers were willing to do extra work because they believe it is their duty and responsibilities.

> *I will share what ever I know with the senior staff. After all, this is my responsibility to make sure the project is successful.*

This is in line with the suggestion by Putnam (2000) that some people will help other "without expecting anything immediately in return and perhaps without even knowing you, confident that down the road you or someone else will return the favour." The interviews revealed that engineers help others in the team not because they expect something in return from the same person. Some of them mentioned that they help because they don't want to disappoint others and feel bad if they rejected their requests.

In Malaysian context, it is almost a culture prevalence within the people that they are not open to sharing with other on many sensitive issues (Merriam and Mohamad, 2000). This is mainly because they are shy, introvert and do not want to hurt others' feelings. It could be postulated that their action is due to not wanting to damage the relationship among the team members and on the other hand would just keep to them for all the consequences. However, this reciprocity may be abused when there is influence from the hierarchy (Edelment *et al*, 2004). Interviews indicate that the junior engineers were willing to share their knowledge with senior members although they do not get credit from it because of power distance or seniority.

Contrary to our expectation, trust did not have a significant impact on intellectual capital. One possible explanation may be that individuals are willing to share their knowledge due to close frequent interactions among members and responsibility towards the achieving goals of the project. The study shows that for a longer term, social interactions such as social ties, reciprocity, trust may increase individual knowledge sharing and hence intellectual capital.

Ultimately, relational capital is a property of the dyad or network that is jointly generated and owned by the team members. Although they have the opportunity to develop the interpersonal relationship, it is still up to their initiative to establish and preserve it (Inkpen and Tsang, 2005). Moreover, these relationships are rewarded by repeated transactions due to commitment, obligation and reciprocity. However, the culture of engineers may hamper the development of relational capital.

In summary, this study has explored the structural dimension of social capital showing how the configuration of team members as shaped by formal structure as well as informal structure assist the engineers to access to knowledge and developed their intellectual capital. This study shows that structural capital provides an opportunity for the engineers to develop a network or access to other team members. Engineers are required to be positioned in the structural network so that they can have frequent interaction with others, be more open and can understand other people. For instance, by working together in the project, it serves as an intra-network which can be further prolonged in the future. The formal meeting and informal meetings that they have attended serve as a connection with others and from there they can identify the potential members with relevant knowledge. The findings also suggest that structural capital together with relational capital helps to promote the development of interpersonal relationship among the engineers. Having said that, both prior history of relationships (Krackhardt, 1992), and opportunity for frequent interactions are requirements for the development of relational capital. These in turn encourage the development of intellectual capital. However, cognitive capital plays a role only among engineers but not with other team members as 'language and culture 'of the engineers hamper their ability to communicate with others.

6.5. Implication for research and practice

The findings indicate that the roles of organisations are to ensure that the engineers are structured carefully to build further relationship. They can provide place enablers for the engineers to enhance their relational capital. It should also be possible to develop richer theory of institutionalisation, one that explicitly addresses both the regulations and enabling roles for social capital development. The reason is social capital need to be developed among the organisational members and it can be managed (Llewellyn and Armistead, 2000). However, once developed it can die if not maintain.

Dimensions of social capital positively relate to the development of intellectual capital. This research contributes to an overall conceptual understanding of the nature and important of knowledge sharing. Indirectly, this study also contributes to intellectual capital development theory. Our findings suggest that dimensions of social capital are helpful in identifying the determinant of intellectual capital development.

The results indicated that social capital dimensions are significant predictor of individual intellectual capital. Managers interested in managing the intellectual capital development should develop strategies or mechanism to encourage the development of social capital among engineers. For example, the company should encourage frequent face-to-face interaction and encourage knowledge sharing through virtual communities. It is also important to ensure that engineers have an understanding and appreciation for the business in building social capital among them.

Collaboration should be encouraged by restructuring structural capital. For instance engineers should mingle with other staffs, share their expertise and learn to accept other team members' ideas and opinions. Management also can invite experts in different field to give talks to them so that they will be more open and knowledgeable in other field as well. The findings also revealed that younger engineers are more open and willing to accept others' opinions and ideas compare with the senior or older engineers. Thus, to motivate younger engineers, they should be given motivating rewards such as encouragement or praise.

6.6. Limitation and Suggestion for future research

This study has limitations. First, the findings could not be generalized to all types of professional and other industries such as manufacturing and service. Therefore, further research is necessary to verify the generalisability of our findings. Second, this study is based on the cross –sectional data collection. While social capital and intellectual capital development requires time and history of interactions, ideal empirical design would be a longitudinal study in order to capture the dynamic interrelationship of social capital dimensions and its impact on the development of intellectual capital.

7. Conclusion

The aim of this paper is to develop further the idea of intellectual capital development among the engineers within the social capital perspective. This study confirms that engineers are required to have social capital in order to develop their own intellectual capital. Our research findings confirm Nahapiet and Ghoshal's framework (1998) that social capital embedded in relationship, is the key intellectual capital development among engineers. Our findings allude that social and intellectual capital are co-evolve. In order to enhance their career development, engineers have to strengthen their relational capital with other organizational members. Apparently, the finding found that engineers are more comfortable when dealing with engineers. Their cognitive capital is only developed among engineers and it hinders them from accepting "outsider' opinion.

References

Allen, T. J. 2002, *Organisational Structure for Product Development*, Working Paper.

Bennett, R. & Gabriel, H. 1999, 'Organizational factors and knowledge management within large marketing departments: an empirical study', *Journal of Knowledge Management*, 3, 3, 212-225.

Bartol, K. M. & Srivastava, A. 2002, 'Encouraging Knowledge Sharing: The Role of Organisational Reward Systems', *Journal of Leadership and Organisational Studies*, 9, 1, 64-76.

Bontis, N. 1998. Intellectual capital: an exploratory study that develops measure and models. Management Decision 36, 2, 63-76.

Bontis, N. 1999. The knowledge toolbox: a review of the tools available to measure and manage intangible resources. *European Management Journal* 17, 4, 391-402.

Bordieu, P. 1986, 'The Forms of Social Capital' in *Handbook of Theory for the Sociology of Education*, eds. J. G. Richardson & C. T. Wesport, Greenwood Press, 241-258.

Brown, J.S., Duguid, P., 1991. Organizational learning and communities-of-practice: Toward a unified view of working, learning and innovation. *Organization Social capitalience*, 2, 1, 40-57.

Cohen, D. & Prusak, L. 2001, 'How to Invest in Social Capital', *Harvard Business Review*, 79, 6, 86-93.

Coleman, J. S. 1990, *Foundation of Social Theory*, Harvard University Press, Cambridge, MA.

Edelman, L. F., Bresnen, M., Newell, S., Scarbrough, H. & Swan, J. 2004, 'The Benefits and Pitfalls of Social Capital: Empirical Evidence from Two Organizations in the United Kingdom', *British Journal of Management*, 15, S59-S69.

Edmondson, A. 1999, 'Psychological safety and learning behavior in work teams', *Administrative Science Quarterly*, 44,2, 350-382.

Gargiulo, M. B. and Benassi, M. 2000, 'Trapped in Your Own Net? Network Cohesion, Structural Holes, and the Adaptations of Social Capital', *Organization Science*, 11, 2, 183-196.

Inkpen, A. & Tsang, E. W. K. 2005, 'Social Capital, Networks, and Knowledge Transfer', *Academy of Management Review*, 30, 1, 146-165.

Koruna, S. 2004 Leveraging knowledge asssets: combinative capabilities-theory and practice, *R&D Management*, 34, 5.

Koskinen, K. J., Pihlanto, P. & Vanharanta, H. 2003, 'Tacit Knowledge Acquisition and Sharing in a Project Work Context', *International Journal of Project Management*, 21, 4, 281-290.

Krackhardt, D. 1992 The Strength of Strong Ties: The Importance of *Philos* in Organisation, In Nohria, N. and Eccles, R.G *Networks and Organisations: Structure, Forms and Actions*, Harvard Business School Press, Boston.

Llewellyn, N. and Armistead, C. 2000 Business Process Management: Exploring Social Capital within Processes, *Business Process Management*, .11, 3, 225-243.

Merriam, S. B., & Muhamad, M. 2000. How cultural values shape learning in older adulthood: The case of Malaysia. *Adult Education Quarterly*, 51, 1,45-63.

Meyer, D.G 1994, Development Interdependence. *Psychology Today*, 27, 4, 35-37.

Moran, P. & Ghoshal, S. 1999, 'Markets firms and the process of economic development', *Academy of Management Review*, 24, 3, 390-412.

Nahapiet, J., Ghoshal, S., 1998. Social capital, intellectual capital and the organizational advantage, *Academy of Management Review* 23,3, 242-266.

Nelson, K.M., Cooprider, J.G., 1996. The contribution of shared knowledge to I/S group performance. *MIS Quaterly*,20,4, 409-429.

Nelson, R.R., Winter, S.G., 1982. Value creation through cross-border networks: Pan-economic change. Presented at the 16th Annual Conference of Havard University Strategic Management Society, Phoenix, AZ.

Newell, S., Tansley, C. & Huang, J. 2004, 'Social Capital and Knowledge Intergaration in an ERP Project Team: The Importance of Bridging and Bonding', *British Journal of Management,* 15, S43-S57.

Nohria & Eccles 1992, Network and Organisation: Structure, Form and Action, *Harvard Business School Press*, Boston, 57-91.

Pfeffer, J. and Sutton, R.I. 2000 The Knowing-Doing Gap: How Smart Companies Turn Knowledge into Action. *Harvard Business School Press*, Boston MA.

Reich, B.H., Benbasat, I., 2000. Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quaterly*, 24, 1, 81-111.

Rockart, J.F. 1998. The line takes the leadership – IS management in a weird society. *Sloan Management Review,* 29,4, 57-64.

Saint-Onge, H., 1996. Tacit knowledge: the key to the strategic alignment of intellectual capital, *Strategy and Leadership*, 24, 2, 10-14.

Simon, H.A. 1991. Bounded rationality and organizational learning. *Organization Science* , 2,1, 125-134.

Sveiby, K-E., 1997. The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets. Berrett-Koehler Publishers, San Fransisocial capitalo.

Swan, J., Newell, S., Scarbrough, H. & Hislop, D. 1999, 'Knowledge management and innovation: networks and networking', *Journal of Knowledge Management,* 3, 4, 262-275.

Ulrich, D. (1998). Intellectual Capital = Competence X Commitment. *Sloan Management Review*, 39, 2, 15-26.

Wasko, M. & Faraj, S. 2005, 'Why should I share? Examining social capital and knowledge contribution in electronic network', *MIS Quarterly,* 29, 1, 35-57.

GNU-PSU Korean Summer Program and SEEK-US (Summer English for Engineers from Korea in the US) Program

Choong Lee [a], John Iley [a], Matthew Keller [a]
Chul Ki Song [b], Gun-Myung Lee [b], Jin-Hoe Kweon [b]

[a] Pittsburg State University
[b] Gyeongsang National University

Abstract

This papers highlights the highly successful Gyeongsang National University (GNU) and Pittsburg State University (PSU) Korean Summer Programs (2001-2005) and its proposed enhancement, the *2008 GNU-PSU SEEK-US (Summer English for Engineers from Korea, in US) Program.* Each program is discussed in significant detail as to provide a basis for replication by Asian universities and cooperating English-speaking countries. Overall purpose of these programs is to provide technology-based experiences that acquaint Korean students with American culture and enhance English-speaking abilities. The two-week, technology and business-related Korean Summer Programs (2001-2005) were designed to accommodate over 30 Korean engineering students. Technical presentations, industrial tours, business guest speakers, and opportunities to experience American culture were components. The program experienced continual improvement. The proposed 2008 SEEK-US Program builds on success of Korean Summer Programs, with significant enhancements regarding English-speaking development using additional industrial tours, expanded technology/engineering-based lectures, demonstrations, and hands-on experiences as motivational catalyst. The innovative structured, immersion-type English development components—English for Engineers (EFE), English for Careers (EFC), and English for Presenters (EFP), are infused with significant technology-based activities that use American Conversational English (ACE) partners working with Korean participants in small groups throughout this program.

Keywords: international partnerships; study abroad; Korea; summer programs; mechanical engineering; English

1. Introduction

This paper highlights the highly successful Gyeongsang National University (GNU) and Pittsburg State University (PSU) Korean Summer Programs (2001-2005) and the proposed sequel and enhancement to it, entitled *2008 GNU-PSU SEEK-US (Summer English for Engineers from Korea, in US) Program.* Each of these programs are discussed in significant detail as to provide a basis for possible replication by other Asian universities with cooperating universities in the United States or other industrialized, English-speaking countries (e.g., Canada). The overall purpose of these programs is to provide technology-based experiences that would acquaint Korean students with American culture and enhance English-speaking opportunities and abilities.

2. GNU-PSU Korean Summer Programs (2001-2005)

2.1. Background

In Spring 2001, Pittsburg State University (PSU) and Gyeongsang National University (GNU) submitted the first "GNU-PSU Korean Summer Program" to the Korean government through GNU. The PSU part of the proposal included a two-week plan for hosting and providing technology and business-related focus sessions, field trips, and entertainment activities for 40 Korean mechanical and transportation engineering students and two GNU faculty. A similar program for 30 students and two faculty members was funded again in 2002, and again for 2003.

2.2. Overall Program Description

The program provides for Korean participants to arrive at PSU late on a Sunday night (usually in the early hours of Monday morning) and begin activities early Monday. Monday morning begins with a formal welcoming reception and brief orientation; followed by a tour of the PSU Kansas Technology Center; and then lunch. After lunch, students receive a tour of the rest of the campus and a more detailed orientation. Typically, some rest and relaxation time is built into the day's schedule, because of their "jet lag".

The remaining nine days of their formal weekday schedule are primarily made-up of five and a half days of technology-related activities and three and a half days of business-related activities. Short general interest activities are sprinkled into some of these days. Some of these general sessions included English development, local cultural information, and presentations by Career Services. The focus of this presentation is on the five and a half "technology days", including technical focus sessions, industrial tours and field trips, and also on closely related weekend activities. The activities are organized around a day with a theme (e.g., Technology Day 1-Automotive Day). For clarification, if certain activities are specific to only one year, that year is noted in parenthesis, (Year).

2.3. Technology-Related Presentations, Industrial Tours and Experiences

The primary focus of Technology's five and a half weekdays is on transportation-related technology, since these Korean students are pursuing careers in aviation, transportation, and mechanical engineering. The topics and tours are organized with this goal in mind. Program organizers also believe that the Koreans should experience Technology Education, as it is taught in the United States, as well as learn more about problem solving and creative thinking.

2.3.1. Day 1 - Composites (Morning, Technology) and Entrepreneurship (Afternoon, Business)

Lecture/Demos: Overview of Plastics and Plastics Applications in the Transportation Industry
Lab Activity Rotations

- Plastic processing labs (Group 1 – 15 students)
    - Injection molding
    - Transfer molding
    - Vacuum thermoforming
- Composite material processing (Group 2 of 15)

2.3.2. Day 2 - Field Trips: Boeing (Wichita, Kansas) and Cosmosphere (Hutchinson, Kansas)

Tour: Boeing Aircraft Assembly Plant–Wichita

- Metal fabrication
- Heat treat and machining operations, including chemical milling
- Fuselage assembly operations
- Preparation of fuselage shipment to Washington

Tour: Cosmosphere–Hutchinson

- Air and space museum
- Largest collection of Russian space equipment outside of Russia
- Examples of displays include: SR71 Blackbird, Apollo 13, X-15, Liberty 7 Mercury capsule

2.3.3. Day 3 - Automotive Technology

Lecture: Performance Testing
Demo: Drivability Dynamometer
Lecture: On-Board Diagnostics
Demo: Scan Tools
Lecture: SAE Mini-Baja
Demo: Engineering Design Competitions (video/live)
Lunch with video footage of SAE Mini-Baja competitions
Lab Activity Rotations (5) - 3.5 hours

- Dynamometer
- Scan tools
- Baja vehicles
- Pitt State Dragster/Toyota visual aids (demos/explanation)
- Transmission dynamometer

Special Demonstration: Pitt State Dragster "Burn-Out"

2.3.4. Day 4 - Diesel and Heavy Equipment (2001-05), and Farm Show (2001, 2003-2005)

Presentations: Series of fluid power lecture - demonstrations

- Forklift hydraulic systems-
- Hydrostatic transmissions
- Pressure flow compensation and load sensing (advanced hydraulics)

Presentation: GPS Lecture/Demo - Speaker from Trimble
Lunch
Four State Farm Show (2001, 2003-2005)

- Nearly 700 exhibit areas; 25,000 people attend per year. Exhibitors include: CAT, John Deere, Kubota, Case IH, and many more.

Diesel Lab Activities (2002-2005)

- Forklift hydraulic systems labs
- Hydrostatic transmissions, pressure flow compensation and load sensing labs
- Miscellaneous heavy equipment and GPS-related activities

2.3.5. Day 5 - Kansas City Trip and Industrial Tours (varied 2001-2005)

Tour: Harley-Davidson Motorcycle Plant Tour (2001, 2003, 2005)

- Frame manufacturing
- Metal stamping, tanks, and fenders
- Assembly of motorcycles
- Finishing and custom painting of "bikes"

- Final test and shipping

Tour: General Motors-Fairfax Assembly Plant Tour (2001, 2004, 2005)

- Assembly of uni-body car
- Build-up of powertrain on subframe
- Preparation for finish
- Paint (restricted, did not see)
- Mating of body and powertrain assemblies
- Soft trim line (installation of interior and glass)
- Pre-delivery testing on "dyno"

Tour: A& E Machining (2002-2003)

- Laser machining
- Stamping and related tool and die development
- High pressure abrasive water jet cutting
- Primarily subcontract jobs from automotive and aerospace

Isle of Capri Casino (Lunch)

Tour: Union Station

- Exhibits have included Titanic (2001)
- Restoration of major train station with historical displays

Tour: Hallmark (2001-2005)

  - Hallmark Exhibit Center – exhibit about their cards and entertainment projects
  - Technology related exhibits include letterpress operation, product manufacturing, and simulation of complete printing and distribution system.

2.3.6. Day 6 - Technology Education, Creative Thinking & Problem Solving

Presentation: Technology Education

- Technology Education in US
- Definition of Technology Education
  - Description of K-12 Technology Education programs
- Technology for All American Project
- Preview of Today's Activities

Tour: Depco, Inc.

  - Product display - complete modular lab facilities
- Product development area
- Manufacturing facility
- Shipping and distribution center

Tour: Pitsco-Synergistic

- Complete modular labs
  - o High school – "Pathways"
  - o Middle school - "Explorations"
  - o Elementary school - "Spectrum Systems"
- Research and development center
- "Dr. Zoon" appearance
- Multimedia production facility
- Shipping and distribution center

Presentation: Creativity and Problem Solving in Technology Education

- Introduction to problem solving
- Steps in problem solving process
  - Introduction to creativity thinking
  - Overcoming Roger von Oech's "TEN Mental Locks" to creativity
  - Creativity thinking exercises
  - Other resources and approaches to creative thinking
  - Introduction to the problem solving activity

TE Problem Solving Activity

  - "Snuff the Candle" or the previous year's TECA Challenge
  - Testing solutions and debriefing of activity

Other Technology Education Demonstrations (optional)

  - CNC laser engraver and CNC vinyl sign maker (graphics for Mini-Baja vehicles)
  - IDL Base Stations, and "Gorilla Ridge" problem solving competition
  - "Conkle's Mechanical Function Display" – models of all gears noted in US Patent Office

2.3.7. Weekend: Other Technology-Related ActivitiesWinston Solar Race (2001)

The high school solar car competition used PSU facilities as an evening rest stop and the Korean students were given opportunity to visit with the racers and look at the cars.

3. MOKAN Drag Racing

The Korean participants are given VIP treatment as they watched the races, interviewed drivers in the pit areas, and toured the control tower. They are taken in small groups to the control tower so they could observe the races and the systems used to gather data from racing performances.

4. Silver Dollar City

A visit to Silver Dollar City provides opportunity to see technologies that were prevalent during the latter half of the 19th Century, including stamping mills, saw mill operations, glass blowing, forging and metal casting process, furniture building, gunsmithing, silversmithing, and many other crafts. Additionally, there is a wide variety of entertainment, including plays about the Civil War, various types of music, comedy skits, and characters in authentic dress throughout the theme park. These activities along with several theme-based amusement park rides provides students with a rich cultural experience.

5. Business-Related, English Development and Career Skills Presentations

For the remaining three and a half weekdays, the Korean participants attend special classes in business (with business tours), intensive English and career development. Business-related topics include: entrepreneurship, international business, and business leadership. The students also visit local businesses and hear from the entrepreneurial founders of these businesses. The career development sessions include instruction on interviewing, dressing for success, resume development, web resources and resumes, and recommended protocols. Intensive English activities include assistance with spoken language and daily journals in English.

6. Findings and Recommendations

The first year of the GNU-PSU Korea Summer Program was a major success, and resulted in subsequent funding and program refinement. Several ideas were developed for future programs (e.g., the GNU-PSU Joint SAE Mini-Baja Project), as well as "Summer Program" recommendations. Feedback from all participants, both PSU and GNU, resulted in the following recommendations and/or improvements:

- **Reduce student numbers.** Reduce the number of participating students from 40 to 30. This makes the overall program much more economical and manageable, logistically. In comparing 2001 (40) to 2002 (30), it was much easier and less expensive organizing transportation, setting up industrial tours, providing entertainment, and know students.
- **Industrial tours.** The industrial tours were the 2001highlight for most students. Planners made sure to include an equal or greater number of tours in 2002-2005.
- **Hands-on activities.** The number of "hands-on" experiences in plastics, automotive, and Technology education were well received and asked to be continued in subsequent programs. Many of the Koreans had learned theory, but not "experienced" these technology activities. PSU faculty found out they should not presume too much in terms of Koreans' previous experiences, including whether they had driven a car (For example, "dynamometer testing a vehicle" and "driving the Mini-Baja vehicle" required more instructional time than originally planned. This was because several students though upperclassmen in college, did not have a driver's license and had never driven a car.)
- **PowerPoint slide handouts.** For the most part, student participants could read English very well, but had difficulty understanding spoken English. Presentations using handouts, that had slides with simplified notes to the side, were very beneficial. Technology prepared, in advance, notebooks with all the handouts and a table of contents. This proved helpful to the students, so they could concentrate on the visual aids and demos during the presentation. Faculty also learned it was best to speak slowly and enunciate precisely. This resulted in less need for the translator.
- **Pick dates carefully to maximize experience.** The dates of the summer program have a major impact on the types of activities and experiences that may be available, as well as costs. For example, the 2001 program was in the last two weeks of July and provided opportunities to tour Harley-Davidson and General Motors, as well as attend the Four State Farm Show and see Winston Solar Race Vehicles. In 2002, the Koreans found they could save several thousand dollars if their flight originated prior to July 1. Unfortunately, GM goes through plant changeover for new models and does not offer tours. Harley-Davidson does not offer tours during this period because they are introducing their new models to their sales people. And finally, the Farm Show is always held during the third week in July.
- **It's a two-way street.** The Koreans are here not only to learn about technology and business, but to also learn about America. US faculty, students and others, took the opportunity to learn about Korea and its culture (and even some Korean language) through regular personal interaction with the Korean participants. The whole "Korea Summer Program" was mutually beneficial. [1]

7. Proposed 2008 GNU-PSU SEEK-US Program (Summer English for Engineers from Korea in US)

7.1. Description of SEEK-US Program

GNU/PSU SEEK-US is a unique immersion English program that features learning conversational English and technical terminology in the context of real-world technology-related experiences. The use of industrial tours, hands-on technology activities in laboratory setting, and technical lecture presentations provide a motivational factor and context for learning "technical English" not found in typical programs. Learning the technical terminology (recognition and pronunciation and sentence context) can provide Korean students a competitive edge in working in today's global markets.

The program uses whole group presentations and activities, to introduce new technical terminology and English helps as part of the **"English for Engineers"** component. This is followed up with small group study and reinforced in subsequent lectures, lab activities, and conversational English sessions. The American Conversational English (ACE) partners are a key component to the success of the program. These ACE partners participate with the Korean students in all the activities, as well as spend approximately two hours a day in conversational English.

"English for Careers" segment emphasizes the development of oral and written skills in the context of writing a resume and letter, as well as participating in a job interview (possibly videotaped). Students also maintain a log/journal of their SEEK–US experiences and develop a two-page "Reflections" paper. The paper is compiled in a book at the conclusion of the class.

"English for Presenters" provides students with tools to develop promotional graphic-based products and presentations. Students have opportunity to develop sales or technical presentations in English using PowerPoint; make posters with vinyl lettering using CNC Signmaker; make T-Shirts with graphics and English text; and laser engrave a product with English text or message, and several activities.

The SEEK–US program makes extensive use of **"Technology Sessions"** (lecture and lab experiences) and **"Industrial Tours"** as a context and motivation for learning English. In past summer programs, as previously descried, many students noted they wished the could stay longer and learn English better so they would understand technical lectures, lab activities, and industrial tour guides better. These technology sessions and tour, coupled with conversational English with ACE partners, should provide a rich English learning experience.

Extensive details about the GNU/PSU SEEK-US program has been developed, but are not included in this paper due to space limitations. However, the objectives noted in this paper provide an idea competencies and deliverables associated with SEEK-US.. The initial offering of this program may serve as "pilot" for future, more refined offerings.

7.2. Purpose of GNU/PSU SEEK-US Program

The purpose of the GNU/PSU SEEK-US is to provide twenty (20) Mechanical and Aerospace Engineering students a unique opportunity to improve English skills–conversationally and written through an immersion in English in the context of real-world technical presentations, laboratory experiences and industrial tours.

7.3. Objectives of GNU/PSU SEEK-US Program

By the conclusion of GNU/PSU SEEK-US program, the participants should be able to:

1. Demonstrate improved conversational English skills, including the use of technical terminology associated with their experiences. [Note: Students will have participated in approximately 40 hours of small group conversational English sessions led by ACE partners, in addition to the other conversations as part of the structured programs.
2. Demonstrate improved written English skills, as evidenced by difference between pre-program writing sample and post-program writing samples that use technical terminology.
3. Make a resume for employment interview.
4. Complete a job interview in English.
5. Complete a five-minute PowerPoint technical presentation in English.
6. Make a vinyl poster in English using a CNC Sign Maker.
7. Laser engrave a product in English
8. Screen print or press-on (transfer press) image and English text on T-shirt.
9. Write a reflection paper in English about their individual SEEK-US experience.
10. Laminate a cover for booklet.
11. Bind personal copy of *2008 SEEK–US Experience Booklet* using binding system demonstrated.
12. Demonstrate processes learned in technical sessions, such as (but not limited to):
    a. Use drivability dynamometer to test engine performance and emissions.
    b. Operate scan tools to perform automotive diagnostics.
    c. Assemble a pattern for doing investment casting
    d. Make a sand casting mold.
    e. Pour a permanent mold casting.
    f. Thermoform a plastic part.
    g. Injection molds a plastic product.
    h. Cut a part using high-pressure water jet.
    i. Make a composite product using fiberglass mat and resins or graphite and epoxy.
    j. Others– several other possible technical performance objectives
13. Demonstrate a greater knowledge of technical processes and subjects presented through English lecture, demonstrations, and hands-on laboratory experiences.
14. Explain the evolution and operation of various American industries toured (e.g., Harley-Davidson, Caterpillar, Ford, GM, etc.)
15. Establish positive, lasting relationships with American students and faculty.

16. Obtain a greater appreciation and understanding of American culture and history.
17. Be a more informed Korean citizen.

    Note: The specific objectives associated with the SEEK–US Program will depend on the actual content of the program developed for implementation in 2008. The above objectives serve only as examples of possible objectives and are provided for discussion purposes only.

7.4. Proposed Time Frame for SEEK-US Program

The nature of the SEEK-US program, with its extensive use of industrial tours, requires a timeframe that takes in to account automotive plant changeover schedules. Also, the schedule needs to take in account the availability of faculty and students to work with the program, as well as the schedule of laboratory spaces. The following timeframes are recommended:

A. Four Weeks – 2nd week in July through 1st week in August [Preferred] (or)
B. Three Weeks – 3rd week in July through 1st week in August (or)
C. Three Weeks - 2nd week in July through 4th week in July

7.5.Proposed Participants for SEEK-US Program Korean Participants (GNU)

1. 20 GNU Mechanical Engineering Students
   a) Five (5) groups of four with at least one female group or
   b) Four (4) groups of five with at least one female group
2. 1 to 2 Faculty
3. 1 to 2 Staff (at least one female to accompany female students)
4. Recommended items for each student participant to bring
   a) Laptop computer w/ wireless capability and Microsoft Office for doing assignments
   b) Small digital camera that can download photos to laptop
   c) 1 pair of closed-toe shoes, long sleeve shirt, and long pants for some industrial tours

7.6. Participants from United States (PSU)

1. Director of SEEK-US Program
   a) Liaison to GNU
   b) Co-author of proposal - budget, logistics, and arrangements
   c) Overall budget. logistics, and arrangements
   d) Coordinate several segments of program
      (1) Non-technology related program activities
      (2) Meals, lodging, and travel arrangements
      (3) Financial and budget items
   e) Co-coordinate several activities
      (1) English for Careers
      (2) Conversational English: American Conversational English (ACE) Partners
      (3) English Activity Deliverables
      (4) Trips and tours
2. Asst. Director for GNU/PSU SEEK-US Technology Programs
   a) Co-author of proposal - program planning and scheduling
   b) Liaison for PSU College of Technology
   c) Program planning and scheduling
   d) Develop GNU/PSU SEEK-US Notebook
   e) Coordinate several segments of program
      (1) English for Engineers
      (2) English for Presenters
      (3) Technology-related programs
   f) Co-coordinate several activities
      (1) English for Careers
      (2) Conversational English: American Conversational English (ACE) Partners
      (3) English Activity Deliverables
      (4) Trips and tours
3. Director of International Studies
4. Faculty and Staff Coordinators for SEEK-US Components
   a) Coordinator for Industrial Tours and Automotive-Related Technology Programs
   b) Coordinator for “English for Careers” Program
   c) Coordinator for “English for Presenters”, and Problem Solving & Creative Thinking Sessions
   d) Coordinator for Manufacturing-Related Programs
      (1) Experiences in Metal Fabrication and Machining (i.e., CNC and Waterjet)
      (2) Experiences in Metalcasting Technology
      (3) Experiences in Plastics and Composites
   e) Additional Technology Faculty/Staff Involved (instructors)
5. American Conversational English (ACE) Partners
   a) 1 per each group of 4GNU students [5 total]
   b) Assist minimum of 40 hours per week for four weeks ($ 6.00/hour)
6. Supporting Staff
   a) Translator (40 hours per week minimum, four weeks)
   b) Assistant to Director of SEEK-US for arrangements (40 hrs/wk minimum, 4 weeks)

7.7. Proposed Trip Locations and Tours

The SEEK-US program proposal provides the option provides a variety of overnight tour packages ranging from seven to twelve days. The determining factor would be the budget. The program can make use of overnight tour trips and/or day trip locations and/or local tours.

Overnight tour locations. To maximize the overnight tour experience, conversational English session and orientation sessions about the tour sites will be included on the trip. Proposed tour locations to select from include:

- Caterpillar facilities (1 day, Peoria, Illinois)
- Ford Motor Company and Deerfield Village (2 days, Detroit, Michigan)
- Chicago, Illinois Cultural Sites (2 days)
- Indianapolis Motor Speedway and Museum, and Cummins Engine Plant (1 day)
- Wright Air Force Museum and Honda (1 day, Dayton, Ohio)
- Chrysler Assembly Plant, Gateway Arch, Anhauser-Busch (1 day, St. Louis, MO).

Day Trips/Activities (tour bus/motorcoach): A less expensive alternative to lengthy overnight tours are day trips, such as those that were part of the Korean summer Program (2001-2005). The following are suggested day trips and/or activities:
Harley-Davidson, General Motors, Kansas Speedway (1 day, Kansas City)
Boeing [now Spirit] and Cosmosphere (1 day, Wichita and Hutchinson, KS)
Silver Dollar City and Bass Pro (1 day, Branson and Springfield, MO)

Local tours: There are several tour locations within a 40 kilometer radius of Pittsburg, Kansas. Sites include:

- Pitsco (1.5 hours) and Depco (1.5 hours)
- Harley-Davidson Training Center/John Deere Ag Tech (2 hours)
- Four State Farm Show (3 hours)
- MOKAN Raceway - Drag Racing (weekend day)

7.7. Replicating These PSU-GNU Partnership Programs on Other Campuses

Many universities have exchange programs in place. The key is to have someone on the home campus to serve as a "champion" for this type of program along with the Director of International Studies. PSU has faculty members from several different countries that serve in this capacity. In the case of Korea, Dr. Choong Lee was born and raised in South Korea, where he attended Seoul National University. After coming to PSU, he established himself as a liaison between PSU and universities in Korea and the Korean government. As a result of his efforts, relationships were established between PSU and the Korean universities. Currently, the strongest relationship is with Gyeongsang National University. For these programs to be replicated at other universities, the universities need to establish similar liaisons and relationships. Also, please note that the individual responsible for International Programs and Services is a key figure in the success of these programs and an excellent source of international grant opportunities.

A major consideration in developing program like this is the level of "spoken" English ability demonstrated by potential participants. Knowing the participants' English skills is critical in developing instructional presentations and making tour arrangements. For high profile industrial tours (e.g., Boeing [now Spirit in Wichita), the University had to provide names, ages, and visa information prior to receiving approval to bring the group.

A key recommendation is "not to assume too much", as was previously noted (e.g., Do not assume that all 20 year olds are licensed to drive.). Similar advice is true regarding safety in laboratory activities and on industrial tours. Do not assume that everyone is aware of common dangers. A brief orientation about safety and acceptable practices preceded each trip and laboratory activity. An interpreter was used on these occasions to assure understanding. Students were required to indicate verbally or with a show of hands their understanding. Students were randomly selected and asked a question, in follow-up to the safety orientation presentation, before continuing with the tour or activity.

8. Summary

In this *"US-Korea Partners in Engineering Education—Joint Technology and Innovation Activities"* series, *Part II. GNU-PSU Joint Korean Summer Program and SEEK-US Program* has initially examined the development and implementation of a two-week, technology and business-related program, designed to accommodate over 30 Korean engineering students. Technical presentations, industrial tours, business guest speakers, and many opportunities to experience American culture were all a part of this program. The program has been very successful with continuous improvement made each year.

Secondly, the proposed 2008 SEEK-US Program builds on the successes of the Korean Summer Programs, with significant enhancements regarding English-speaking development using additional industrial tours and expanded technology and engineering-based lectures, demonstrations, and hands-on experiences as motivational catalyst. The innovative use of structured, immersion-type English development components—English for Engineers (EFE), English for Careers (EFC), and English for Presenters (EFP), are infused with significant technology-based activities; and make use of American Conversational English (ACE) partners working with Korean participants in small groups throughout the duration of the program..

Engineering universities are encouraged to take ideas presented in this paper and develop their own partnerships and programs. Such efforts are richly rewarding for all constituents.

References

1. J.L. Iley, M. Keller, US-Korea partners in technology and innovation activities, Proceedings of 57th International Technology Education Association, Nashville, TN, 2003.

Marine Engineering as Future Career for Malaysians

Ab. Saman Abd. Kader[a], R.P. Sinha[b], Mohd Zamani Ahmad [c], Oladokun Sulaiman Olanrewaju [d]

[a] Professor, Director of Training and Education, Akademi Laut Malaysia
[b] Principal lecturer, Akademi Laut Malaysia
[c]Associate professor, Universiti Teknologi Malaysia
[d] Lecturer, Akademi Laut Malaysia

Abstract

In the present technology intensive maritime industry, the employability of seafarers is directly linked to their level of competency in the required skills. Perhaps, this is the main reason why crew members from certain countries and regions enjoy preference in the employment market in comparison to others. Therefore, the employment potential or career prospects of Malaysian seafarers should be viewed from the perspective of their competency in those skills which are necessary for the safe and efficient operation of modern ships and marine crafts. The competency level of seafarers is, however, strongly related to the kind of training they receive from local as well as overseas MET institutions. In this paper, the authors review technological developments in the maritime industry in last 10-15 years and highlight the limitations of the STCW 95 training standards in fully meeting the knowledge demands of high technology equipment on board new merchant ships. Then, based on this information, the authors identify essential training needs of Malaysian seafarers which are necessary to make them fully competent to be able to man the present as well as future high technology merchant ships. Also, to address this issue, ALAM has taken certain important initiatives by way of enriching its current MET curriculum, much beyond the minimum stipulation of the STCW 95, and benchmarking with leading world class MET institutions will be reported. The DNV Sea-Skill audit and certification is an example of the commitment that ALAM has made to offer a program for competence beyond compliance.

Keywords: Maritime, engineering; career, opportunity, training, education

1. Introduction

Due to ever rising fuel prices, stringent environmental restrictions, deteriorating global security and sharp increase in the salary of seafarers the shipping business has become very competitive. This is compelling ship owners to adopt new and more advanced technologies which can bring down the over all ship operating cost and guarantee them viable return on their investment. This new shipping business environment is gradually bringing about changes in the ship design practices, shipboard operational procedures and optimization in routing and voyage planning to ensure over all most economical operation of the vessels.

Hence, in new ships, now it is quite common to find increasing use of ICT and other advanced technologies such as Distributed Control Systems (DCS), on line machinery fault diagnosis system using neural network/Fuzzy logic based mathematical models of the propulsion plant and vibration analysis techniques for condition monitoring etc to achieve best performance, in terms of reduced man power and lower cost of maintenance. The new ships are, therefore, technologically more advanced in comparison to their earlier generations and offer significant benefits in terms of fuel consumption, low maintenance, greater cargo carrying capacity, more safe/environment tolerance and reduced manpower. Of course, these benefits have been obtained at the cost of using high technology components and systems for the hull, machinery and propulsion controls which places extra competency demands on the shipboard personnel.

Because of all these developments, the technical and commercial viability of traditional propulsion plants are already under close scrutiny and new more fuel efficient alternatives are slowly replacing the old installations. Some of the most promising alternative propulsions under considerations by many ship owners are the all electric integrated system, fuel cell systems and GT based hybrid cogeneration conventional mechanical propulsion systems. These new alternative propulsion systems integrated with advanced technology tools will offer better fuel consumption, less maintenance, longer machinery life, environmental safety resulting in increased ship availability and better over all financial returns to the ship owners.

However, the introduction of these advanced technologies in the new and future ships have obvious implications on the education and training of seafarers. The old traditional methods of MET conceptualized by the IMO which is implemented through the instruments of STCW 95 is no longer able to meet the challenges of these new shipboard technologies. This is already becoming evident from the many catastrophic accidents reported from time to time where the lack of crew competence in the operation of high technology equipment have been pointed out to be the main contributing factor in the incident.

To address this issue effectively, the MET institutions will require taking urgent steps to produce competent seafarers who can confidently and safely handle the advanced technology equipment on board new ships. This calls for the MET institutions to take a serious review of their current STCW 95 compliant training curriculum and realign with the future technology needs of the maritime industry. Some countries who were more proactive, anticipated these events long time ago and have taken timely measures to improvise and upgrade their training curriculum in line with the future needs of the maritime industry. But, in Malaysia we have not been so alert to this issue which will have a definite impact on the future employment prospects of our seafarers.

Recognizing that, we at ALAM, taking advantage of our networking with a few leading world class MET institutions, have taken note of these technological developments and are carrying out the necessary changes in our curriculum. There is also a need for the other institutions of higher learning in the country to share this responsibility by introducing appropriate technical courses in their programs which fall well outside the academic scope of ALAM.

2. Review of Ship Propulsion System

Traditionally, for the reasons of fuel economy and reliability, merchant ships have been fitted with steam turbines and slow speed direct coupled diesel propulsion systems. However, with rising cost of fuel and increasing uses of ICT in merchant ships the search for low maintenance, reliable and fuel efficient propulsion systems has gained priority. The following paragraphs report some of the most promising propulsion systems which are emerging attractive alternatives for new ships.

2.1. Diesel propulsion

The single, slow speed two-stroke diesel engine, burning heavy fuel oil and connected directly to a fixed pitch propeller, is the marine industry's established benchmark for optimum fuel efficiency. But, while these engines give satisfactory performance in smaller ships, for the power requirements of large tankers these advantages are greatly lost mainly because increased size of the hull requires bigger power packs sometimes with twin shaft configurations. Sometimes to enhance the fuel efficiency of these propulsion systems, in large ships exhaust gas fed cogeneration system has been proposed which considerably improves the fuel savings. The search for alternative propulsion system for LNG tankers has been even more urgent to prevent losses from forced burning of the valuable boil off.

Configuration of a typical proposed propulsion systems for LNG tankers which is incorporated with sophisticated fault diagnostics tools is shown in Fig. 1 below [1].

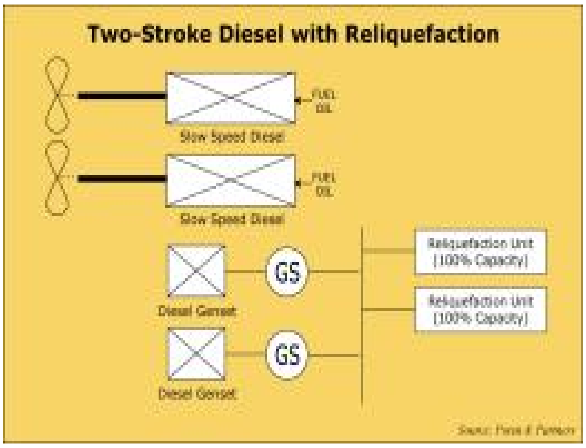


Fig-1.

2.2 Gas turbine propulsion

Because of the light weight and low mechanical vibrations gas turbines have been a preferred propulsion system for the naval warships for a long time despite their high fuel consumption. However, with enhanced technology of the gas turbine designs they are also now becoming more fuel efficient and attractive for powering many special types of merchant ships. From their experience of gas turbine propulsion systems in naval and cruise ships, Lloyd's Register have issued an approval in principle of GE Energy's LM2500-based, gas turbine propulsion system for use in liquefied natural gas (LNG) ships [2]. In another paper [3] Lloyd's Register Asia report a recently completed study of the first full safety case of a gas turbine propulsion system for LNG carriers of 250,000 cubic meters and above for Rolls-Royce's MT30 system. This study was carried out in conjunction with Daewoo Shipbuilding & Marine Engineering Co, Ltd (DSME) and Rolls-Royce, this work was designed to fulfil the requirement of the oil majors involved in the

Qatargas and RasGas projects that ship-owners, yards and class ensure that proposed ship design concepts are as sound as practicable. The turbines will have duel fuel capability and drive 6.6-11 kV generators which will drive propulsion motors and also power all the auxiliary electrical loads. The system is proposed to operate as combined cycle cogeneration plant to raise efficiency level comparable to 2 stroke slow speed diesel engines.

2.3. Electrical propulsion system

In some applications, the electrical propulsion system has been identified as preferred solution because of its certain very specific features which offered inherent benefits in terms of overall operating cost and flexibility of design. Because of that electrical propulsion schemes have been now adopted for numerous applications ranging from warships to research vessels, icebreakers, cruise liners, shuttle tankers, offshore support vessels, survey ships etc [1]. In particular, the following factors make electric propulsion a superior alternative to conventional systems for new merchant ships.

i. Gas Turbines propulsion with cogeneration
ii. Reduced total installed power
iii. Low fuel consumption and emissions
iv. Enhanced maneuverability/crash stop
v. Flexible, redundant configurations
vi. Increased cargo capacity.
vii. Enhanced reliability and availability :

The type of propulsion system for merchant ships will primarily depend upon their size and cargo carrying capacity. In integrated electrical propulsion system a common power plant can be used for both propulsion and cargo handling which offers opportunity for load optimization resulting in substantial reduction in total installed power. Schematic layout of a typical Integrated electrical propulsion system used in a medium size LNG ship of 153 km ^{3} capacity supplied by ABB is shown in fig-2.

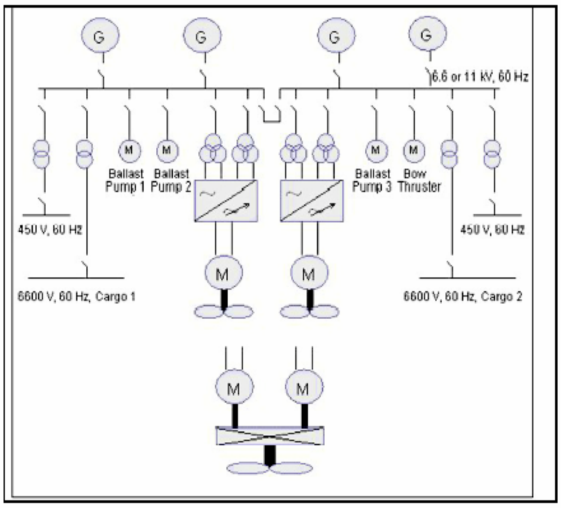


Fig 2

I In this propulsion system, four medium speed duel fuel diesel engies drive respective AC generators to produce 6.6 kV, 60 Hzs electrical power which energise propulsion motors and also the auxiliary services after stepping down to 440 V. The 2 x 14 MW medium speed propulsion motors are connected to a common gear-box for driving a single fixed pitch propeller. Each motor is controlled by an ACS 6000SD frequency converter, which is the latest generation of MV (medium voltage) drives from ABB utilizing IGCTs (Integrated Gate Commutated Thyristors) as switching devices and the ABB patented DTC (Direct Torque Control) principle for synchronous motor drive. The DTC control is developed for optimizing the dynamic torque response and minimizing the torque ripple on the motor shafts, hence leading to minimized machinery induced vibration and noise levels [4].

The above review reveals that, the following advanced technologies are progressively entering into the shipboard engineering systems though implementation of advanced design procedures and operating practices.

i. Gas Turbines propulsion with cogeneration
ii. Fuel Cells propulsion with advanced power electronics
iii. High Voltage Systems
iv. Permanent Magnet Motors/ Generators
v. Power Electronics and AC Variable Speed Drives
vi. Microprocessors based instrumentation and controls
vii. Distributed Control Systems
viii. Vibration analysis and condition monitoring
ix. Neural Networks and Fuzzy Logics
x. Model Based Machinery Fault Diagnosis

The current MET programs which mostly comply to the STCW 95 guidelines are based on the shipboard technology of the 1980-1990s and hence fail to adequately address the training needs of these new technologies. Therefore, the revised MET programs for the seafarers should be retailored to include these technologies.

3. Current MET Curriculum of ALAM

ALAM offers comprehensive MET programs comprising of pre-sea, Post Sea and short modules of ship safety and HSE courses.

(1) Pre Sea Training Programs

ALAM offers a 3 years diploma program of 99 credits which focuses mainly on the operational and applied aspects of the marine engineering. The curriculum is based, on the STCW 95 guidelines and is conducted in six semesters as shown in appendix. The course contents of the post sea training program is also tailored on the guidelines of STCW 95 and is placed at the appendix for reference

4. MET Competency Gaps

Review of the current MET programs of ALAM at appendix, reveals that the thrust is mainly on the development of competency skills and the coverage of new shipboard technology is greatly lacking. The most glaring technology discrepancies are found in the following areas.

- Gas Turbines
- Fuel Cells
- High Voltage technology
- Permanent Magnet Motors/ Generators
- Power Electronics and AC Variable Speed Drives
- Microprocessors based instrumentation and controls
- Vibration analysis and condition monitoring
- Neural Networks and Fuzzy Logics
- Model Based Machinery Fault Diagnosis

5. Initiatives Taken By ALAM

To address this technology gap in the MET curriculum, ALAM has taken a number of initiatives and is implementing the following action plans.

(i) Review of the existing MET curriculum

A thorough review of the existing curriculum of marine engineering program has been taken up on priority with the objective of replacing the out dated topics under STCW 95 with the more relevant ones which can support the training needs of new shipboard equipment.

(ii) Certification of Curriculum by DNV Sea – Skills

ALAM has hired the services of internationally renowned MET consultants the DNV Sea-skills of Norway to benchmark the curriculum with world class MET institutions. The first phase of this benchmarking has been already completed and the DNV is continually auditing the curriculum to raise the course contents to the required world class levels

(iii) Mechanical Engineering Diploma Bridging Program

A proposal to induct mechanical engineering diploma/degree holders through a bridging program has been submitted to the Marine Department for approval. This scheme is intended to cut short the duration of the overall MET program to almost half and also introduce some additional technical skills which could not be included in the marine engineering diploma program of ALAM due the constraints of credit hours. The first batch of graduates under this scheme is expected to join by early 2008.

(iv) Networking and Benchmarking with leading METs

To promote academic exchange and share their experience ALAM has signed MOU with very distinguished world class MET institutions such as World Maritime University, Merchant Marine Academy of USA, Australian Maritime College and South Tensyde College, UK, besides of course with few local universities which also include UTM. This networking provides opportunity for benchmarking and in the long run it is intended to bring global recognition to ALAM as MET institution of good standing. Also regular faculty exchange with some of these institutions has been practiced to derive mutual benefits.

(v) Faculty Shipboard attachments

Being directly under the management of MISC is a great advantage to ALAM as it offers opportunity to the faculty members to remain updated with the latest shipboard technology. Taking advantage of this facility, special shipboard training programs are drawn for the faculty members on a regular basis and included in the annual calendar for implementation.

(vi) Conducting short technology specific courses for the industry

Due to increasing entry of new technology in the shipping industry frequent requests come from the ship owners to conduct special short courses to meet their urgent operational needs. The following short courses of durations varying from 3-7 days have been developed and offered to the industry on demand.

- Distributed Control Systems
- Marine Electrical & Electronic
- High Voltage
- Energy Conservation and management
- Hydraulic and Pneumatic Control
- Gas Turbine Technology
- Cryogenics and re-liquefaction of NG
- Shaft and Machinery alignment

Although these courses have been offered on regular basis the effectiveness is limited mainly because the participants lack the basic foundations necessary to grasp the advanced technology. To ensure proper understanding of these courses the participants need to be introduced to the fundamentals of these technologies at pre-sea stage of their training.

(vii) Ship Simulation Center

Simulation based training has been popular and effective in the shipping industry and the well established METs institutions are offering this mode of training. Recognizing this requirement ALAM has set up a ship simulation center which offers training for the following courses

- Ship Handling Simulation Course
- Engine Room Simulation Course
- Cargo Handling Simulation Course

The simulation center is also well equipped for conducting research and consultancy work by the maritime professionals and academia

(viii) Enhancements of laboratories and workshops facilities

The engineering branch campus in the east coast at Kuala Terangganu is now located in the campus of Institute Technology Petroleum Petronas which offers great opportunity to share all their training and logistic facilities. In particular, the newly created high voltage practical training facility (only 2^{nd} facility in Malaysia after TNB) and the gas turbine laboratory are two very special training facilities which will be of great value for high technology training in future. Besides these facilities MISC has donated large number of used shipboard machinery and equipment for conducting skill based practical training.

(ix) Enhanced utilization of training ship

Availability of ship training facility has great learning value and any MET institution of some standing always aspires to provide this training if they can afford to. In this regard, ALAM has been very fortunate to be gifted with a fully operational chemical tanker by the MISC which is utilized to the fullest extent for conducting the pre-sea as well as post sea training. To reinforce the practical ship training further, the MISC has also converted two LNG tankers into cadets training ship with additional accommodation for 30 cadets in each.

6. Role of other national MET Institutions

Since ALAM is permitted to conduct only diploma level programs, there is restriction to the technical contents that may be included in its MET curriculum. Therefore, other national institutions who also offer MET programs and particularly those offering degree and higher level courses need to come forward and join ALAM in addressing this issue. In particular, UTM and UMT who offer post graduate and Ph.D programs in the MET related fields are better placed to address the advanced technology end of the issue by promoting research and development in those areas. This may be better achieved by suitably restructuring their post graduate programs which facilitates registration of the working professional from the maritime industry for those courses. This will ensure that Malaysian seafarers are adequately trained to meet the challenges of future shipboard technology and thereby remain globally employable.

In fact technical topics such as neural networks, fuzzy logic, distributed controls, vibration analysis and high voltage technology etc are already active areas of post graduate research, particularly in UTM, and hence the issue of bridging technology gap merely requires effective integration of these research activities with the industry. In this regard recently created MISC professorship chair at UTM is very timely and should become the nucleus for maritime technology research at the national level.

7. Conclusions

To ensure that Malaysian seafarers remain competitive in the global employment market, they need to be trained in the advanced technology of current ships. The authors identify the technology base of current and future shipboard equipment/machinery and highlight the training gaps of the Malaysian seafarers. This requires many corrective actions at the national level to enhance their training much beyond the current scope of

STCW 95 guidelines and make them competent to meet the technology challenge of new ships and thereby enhance their employability globally.

ALAM is implementing a number of initiatives to meet this technology challenge which include revision of the MET curriculum, course certification by the DNV and also general enhancements of the training infrastructure. The authors also highlight the role other national institutions of higher learning need to play in addressing this issue and suggest restructuring their postgraduate programs which can facilitate participation of practicing engineers from the industry in applied research. This will greatly accelerate the industry academia interactions and also promote shipboard technology transfer.

References

1. Poten and Partners: Monthly Publication. LNG Propulsion System: Is diesel the future? LNG world wide market http//www.poten.com/contact.asp
2. Harper Tan: Future development options for LNG marine transportation; American Institute of chemical engineers, spring national meeting in New Orleans March 10-14, 2002. Second natural gas utilization topical conference, session TCa02, http://www.wavespec.com/pdfs/FutDev.pdf
3. Lloyd's Surveyors: Lloyd's approve GE energy's gas turbine propulsion for LNG ships, Scandinavian Oil –Gas magazine, online LNG news, 18 May 2005, http://scandoil.com/moxie
4. Jan Fredrik Hansen and Rune Lysebo : ABB marine group, Norway, published in LNG journal pp 11-12, October 2004
5. Bolton T W: Keynote address, All electric ship, conference proceedings part-2, 1998 pp 1-2, Institution of Marine Engineers
6. Malaysian Maritime Academy: Course outline and syllabi of Pre-sea marine Engineering Diploma Program, 2005 version
7. Lever NDJ and Stobart R: Fuel Cell system for surface ships, All Electric ship, Conference proceeding part 2, 1998, page 30-34, Institution of Marine Engineers
8. Sinha R P and Zahid Mohd B Zain: Integrated Electric Propulsion System for LNG Ships, MARSTEC 2007, 22-23 February 2007 , Kuala Lumpur

Appendix

Pre-sea Training Program

SEMESTER 1

Code	Subject	Credit
1.DEA 1012	English Language i	**2**
2. DEA 1023	Mathematics I	**3**
3.DEA 1033	Thermodynamics I	**3**
4. DEA 1043	Applied Mechanic I	**3**
5. DEA 1053	Electrotechnology I	**3**
6. DEA 1061	Engineering Materials	**1**
7. DEA 1071	Engineering workshop practice	**1**
8. DEA 1131	Laboratory I	**1**
9. LAN 1082	Engineering Workshop Skills I	**2**
	Total Credit Hours	**19**

SEMESTER 2

Code	Subject	Cre
1.DEA 2012	English Language II	**2**
2. DEA 2023	Mathematics II	**3**
3.DEA 2033	Thermodynamics II	**3**
4. DEA 2042	Naval Arch and Ship Cons.	**2**
5. DEA 2053	Marine Engineering Knowledge	**3**
6. DEA 2061	Computer Application	**1**
7. DEA 2071	Instrumentation	**1**
8. DEA 2082	Engineering Workshop Skills II	**2**
9. LAN 1053	Moral/Islamic Study	**3**
	Total Credit Hours	**20**

SEMESTER 3&4

Code	Subject	Credit
1.DEA 3018	Shipboard Trainin Mandatory Completion of a. MARDEP Training Record Book b ALAM Correspondence Course	**18**
	Total Credit Hours	**18**

SEMESTER 5

Code	Subject	Credit
1.DEA 5013	Electrotechnology II	**3**
2. DEA 5024	Engineering Drawing	**4**
3.DEA 5033	Electronics	**3**
4. DEA 5042	Naval Arch and Ship Const- II	**2**
5. DEA 5053	Applied Mechanics II	**3**
6. DEA 5061	Laboratory II	**1**
7. DEA 5071	Introduction to Management	**1**
8. DEA 5082	Plant /Laboratory Training I	**2**
9. LAN 1013	Bahasa Kebangasaan	**3**
	Total Credit Hours	**22**

SEMESTER 6

Code	Subject	Credit
1.DEA 6012	Engineering Design	**2**
2. DEA 6023	Engineering Knowledge Motor	**3**
3.DEA 6033	Engineering Knowledge General	**3**
4. DEA 6043	Engineering Knowledge Steam	**3**
5. DEA 6052	Marine Controls and Automation	**2**
6. DEA 6062	Marine Electrical Practice	**2**
8. DEA 6082	Plant/Laboratory Training II	**2**
9. LAN 1033	Moral/Islamic Study	**3**
	Total Credit Hours	**20**

Post Sea Training Programs

Module 1	Applied Mech & Heat Engines	14 week
Module 2	Mathematics and Engg Drawing	14 week
Module 3	Electrotechnology and MEP	4 week
Module 4	Naval Arch.and Ship Const.	4 Week
Module 5	Engineering Knowledge (Steam)	6 Week
Module 6	Engineering Knowledge (General)	6 week
Module 7	Simulator/Trg Ship Exerc & Oral	

Entrepreneurship Intent Among Technical and Non-Technical Students in Universiti Teknologi Malaysia (UTM)

Mohd. Hassan Mohd. Osman, Hishamuddin Md. Som, Hanim Sulaiman, Koe Wei Loon

Faculty of Management & HRD, Universiti Teknologi Malaysia

Abstract

Universiti Teknologi Malaysia is one of the engineering universities that offer entrepreneurship as a subject to its engineering students. Studies have shown that businesses run by persons who have taken such classes are much more likely to be successful. It was recommended by industry and professional organizations in Malaysia to work also on the entrepreneurial skills of the engineering graduates, which resulted in the subject entrepreneurship for engineering students. Based upon Gibb's (1987) model, the researcher proposed a revised conceptual framework for the study. The model includes personal characteristics and functional skills as the factors influencing entrepreneurship development. Furthermore, the model also include the study on the intention to possibly start up own enterprise. A total of 400 final year students from the various faculties in Universiti Teknologi Malaysia were selected as sample using stratified sampling technique to ensure fair representation of the population due to the dominance of certain faculties. Out of the 400 questionnaires sent out, 372 sets were completed and returned. The study found that both technical and non-technical students are motivated by the level of entrepreneurship education and training that they have received on entrepreneurship. Both are motivated also by life experience, environment, and personal characteristics for entrepreneurship.

Keywords: entrepreneurs; entrepreneurship education and training; entrepreneurship intent; entrepreneurship motivation; enterprise

1. Introduction

There is tremendous interest in entrepreneurship around the world. The last decade of the 20th century is marked with rapid growth of new businesses due principally to innovative technological changes. New business growth and the subsequent employment growth were largely triggered by entrepreneurial effort both in new startup activities. According to the Global Entrepreneurship Monitor (GEM) 2003 study, about 300 million people, or 12.5%, of the adults in the 40 countries surveyed, are involved in forming new businesses (Barringer and Ireland, 2006).

Entrepreneurship is the essence of free enterprise because the birth of new businesses gives a market economy its vitality. According to Bygrave (1997), entrepreneurs are driving a revolution that is transforming and renewing economies worldwide. Moreover, new and emerging businesses create a very large proportion of innovative products that transform the way we work and live. Furthermore, these businesses also generate most of the new jobs in the employment market. Timmons (2007) pointed out that entrepreneurs are critical contributors to a nation's economy, and their contributions include leadership; management, economic and social renewal; innovation; research and development effectiveness; job creation; competitiveness and productivity; the formation of new industries; and regional economic development. It is commonly believed that entrepreneurship does have a significant effect on a nation's economic growth and it is a solution for unemployment (Sinha, 1996; Hynes, 1996; Mäki, 1999; Dana, 2001; Rosli and Mohmad, 2003).

However, starting up a new firm is very much an individual decision, which is why the individual's qualities as an entrepreneur are central in the investigation of entrepreneurship. During the start-up phase of a firm, the important characteristics an entrepreneur must have include innovativeness and the will to act (Tibbits, 1979; Bird, 1989). Innovativeness means that the entrepreneur must have the ability to produce solutions in new situations. This is presumably linked with the entrepreneur's abilities, attained through training, education and experience. The will to act, besides being in part the product of experience, is probably connected with the entrepreneur's training and the resources under his/her control. These factors shape the values and attitudes of the entrepreneur (Littunen, 2000).

The essence of entrepreneurship is evaluating and incurring risk and making decisions that maximize the likelihood of success, investing capital and time creatively and managing production and sales in hope of success in the market. Entrepreneur need to evaluate possibilities, distinguish business opportunities from ideas, determine alternative path for pursuing opportunities and asses possibilities of successful introduction and growth of their innovations (Gross, 2000). Although personal aptitude for innovation is helpful, there is no guarantee of success.

From the first day the concept of entrepreneurship was introduced, there was a perception that entrepreneurs are born but not made. Most who argued that entrepreneurs are born suggested that entrepreneurs have innate characteristics that set them aside from other people (Henderson and Robertson, 1999). As discussed by Rohaizat and Fauziah (2002), many people believe entrepreneurship is the result of guts feeling, internal drives, timing and luck. One good example is Bill Gates, who chose to leave the grand ivy league of Harvard, halting entrepreneurship education in seeking entrepreneurship experience. Therefore, many have seen the individual as important for enterprise, indeed as key to its success (Bridge *et al.,* 1998). Nevertheless, this belief is not necessary so. Many researches showed that there are other factors that shape an entrepreneur. These factors include personal characteristics, entrepreneurship education and skills, social and environment, as well as life experience. Of these factors, personal characteristics is believed to be the most influential factor that motivates an individual to be an entrepreneur (Habibah and Zaidatol, 1995; Sinha, 1996; Bridge *et al.,* 1998; Mäki, 1999; Van Gelderen *e. al.,* 2001; Rosli and Mohmad, 2003). The various types of personal characteristics can drive a person to be an enterprising individual and eventually bring success to the business.

However, it is now widely accepted that entrepreneurship can be taught and developed, provided that the right kind of environment is created (Gibb 2000). Drucker (1985) make a clear case that entrepreneurship skills can be acquired or learnable. It is not the purpose of this paper to discuss whether entrepreneurs are born or entrepreneurship can be taught.

2. Entrepreneurship education

Just about a few decades ago, there was not much interest in teaching entrepreneurship at business schools as the perceived wisdom was that it could not be taught. But, today it is a hot elective for young students and even MBAs. Many top line business schools trumpet their entrepreneurial studies programs (Bakri, 2002). As an example, in United States, most universities offer courses in entrepreneurship, and many business schools offer major in entrepreneurship along with majors in more traditional business areas such as finance, accounting and marketing (Kolvereid and Moen, 1997). As pointed out by Rosli and Juhary (2001), Malaysian students have embarked on the entrepreneurship since their secondary school education. Students are further exposed to entrepreneurship in their tertiary education as most of the higher educational institutions offer entrepreneurship as core or elective subject.

In addition to the efforts shown in entrepreneurship education, the Malaysian government has taken various steps to promote entrepreneurship in general. These include provide a conducive economic environment, various financing and funding schemes, tax incentives as well as business advisory center (Mohamed and Syarisa, 2003). According to Mohamed and Syarisa , among the foremost measures was the establishment of a special ministry for entrepreneurs, the Ministry of Entrepreneur and Cooperative Development in 1995, clearly showcases the importance the government places upon the issue of entrepreneurship and entrepreneur development. As a result, there were an increasing number of new businesses set up in Malaysia after the Asian economic crisis in 1998. The number increased from 18,825 in 1998 to 27,756 in 1999 and 16,155 for the first six months of 2000 (Mohamed and Syarisa, 2003).

Today, entrepreneurship can be considered as a common taught subject in most universities, colleges or even schools (Rosli and Juhary, 2001). Together with the additional efforts from the government, it is highly expected that youths in Malaysia, especially the educated ones, should be sufficiently motivated enough to set up their own enterprise. However, the research on entrepreneurship education into the technical and non-technical programs in universities has still not been fully investigated. Therefore, this study will attempt to identify various factors among undergraduate students to consider entrepreneurship as their career.

Universiti Teknologi Malaysia is one of the engineering universities that offer entrepreneurship as a subject to its engineering students. Studies have shown that businesses run by persons who have taken such classes are much more likely to be successful. It was recommended by industry and professional organizations in Malaysia to work also on the entrepreneurial skills of the engineering graduates, which resulted in the subject entrepreneurship for engineering students. One of the implications of the shift towards business units is that unit management requires a larger involvement of more people in running a company and a shift from top-down in the direction of bottom-up. Engineers and scientists could no longer focus only on engineering activities, but also have to deal with ‘make or buy’ decisions, marketing, finance, and managerial affairs. This calls for other skills in addition to the regular engineering skills (Bonnet et al., 2006).

3. Entrepreneurship intent

Several researches showed that the motivational factors discussed in the previous section will affect the intention or inclination for an individual to possibly start new enterprise (Parnell *et al.*, 1995; Koh, 1996; Kolvereid and Moen, 1997; Mäki, 1999).

In a research to study on entrepreneurial propensity, Parnell *et al.* (1995) measured the intention to entrepreneurship by asking the respondents to select one from three possibilities. The possibilities are: plan to operate own business immediately after graduation; plan to operate own business within 5 to 10 years after graduation; and plan to operate own business after 10 or more years. The measurements are simple and easy to understand. Nevertheless, they may not be able to measure the intention in a more precise and accurate manner.

Another researcher, Mäki (1999) measured the intention by using rating method. Respondents were required to select from a series of six answers ranging from never considered about starting own enterprise as the lowest to already an entrepreneur as highest. The measurements are similar to the previous study, but they are more complex and accurate. In addition, they are also easy to understand and apply to the research.

To overcome the limitations in the previous studies, Koh (1996) measured the intention for entrepreneurship by asking the respondents to indicate their probability to set up new enterprise. Respondents who have a high or very high probability of starting a business are classified as entrepreneurially inclined, and the others, are classified as non-entrepreneurially inclined. The measurement is easy and simple. Moreover, it is more quantifiable in measuring the intention and able to reflect the degree of intention in a better way.

A better set of measurement was introduced by Kolvereid and Moen (1997). The researchers measured the entrepreneurial intention by developing an index of entrepreneurial intention. Three different measurements were taken from the respondents before the index was obtained. The first measurement was the probability to start a new business. Respondents were asked to indicate the probability to start new business in percentage. The second measurement was a measure of choice intentions. Respondents were required to choose between self-employed or employed by someone. For the third measurement, respondents are asked to determine the probability to pursue self-employed during working life. The probability was expressed in percentage form. Compared to the previous measurements, these measurements are more accurate and quantifiable. Nonetheless, they are complex in calculation and difficult to understand.

4. Conceptual framework of the study

Based upon Gibb's (1987) model, the researcher proposed a revised conceptual framework for the study. However, there exist several apparent limitations in Gibb's model. First, very little was discussed regarding personal characteristics in the model. The second drawback relates to the neglect of practical functional skills as one of the motivational factors for entrepreneurship. The last shortcoming is that the model failed to show the relationship between the motivational factors and the intention to possibly start up own enterprise. Therefore, to off set these limitations, the researcher proposed a model (Fig. 1) which includes the personal characteristics and functional skills as the factors influencing entrepreneurship development. Furthermore, the model also include the study on the intention to possibly start up own enterprise.

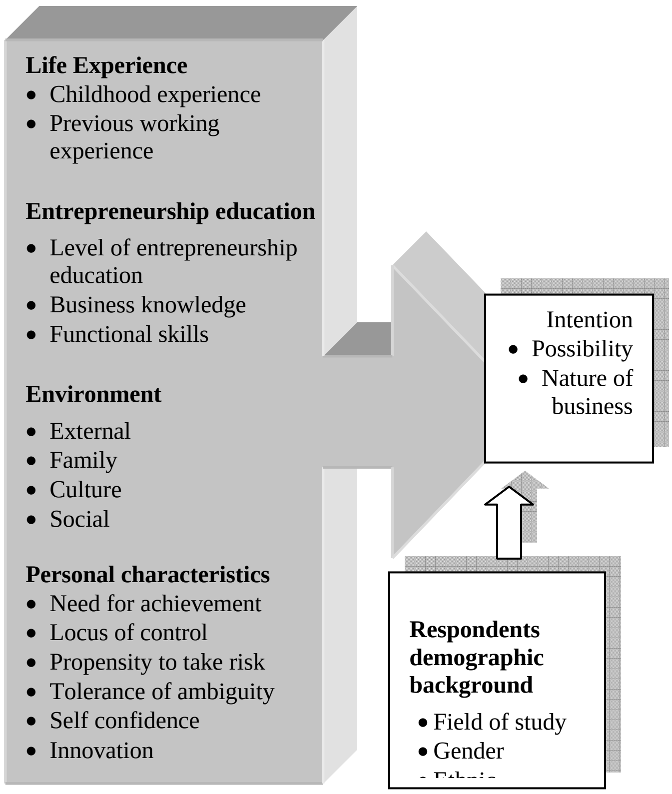


Fig. 1. The conceptual framework of the study

Fig. 1 shows the model proposed by the researcher. It is shown that an individual is affected and influenced by four main motivational factors in choosing entrepreneurship as career. The factors are (1) Life experience; (2) Entrepreneurship education; (3) Environment; and (4) Personal characteristics. Life experience consists of childhood experience and previous working experience. Entrepreneurship education comprises level of entrepreneurship education and functional skills. Environment relates to family, culture and social. Personal characteristics consist of need for achievement, locus of control, propensity to take risk, tolerance of ambiguity, self confidence and innovation. From the study in the previous chapter, it indicated that these factors are capable of influencing the intention to possibly start up own enterprise by an individual. Thus, this study will examine the respondents' intention to possibly start up own enterprise as well. The intention relates to the possibility of setting up own enterprise and the nature of preferred business. The demographic variable comprises the personal background of respondents, such as field of study, gender and ethnic.

Previous studies have clearly indicated that there is a relationship between motivational factors and intention to possibly start up own enterprise. Hence, the relationship will not be tested again in this study.

5. Methodology

5.1. Population and sampling procedure

The population of the study comprises of all final year undergraduate students in UTM main campus. The population of the study consists of 6186 students. The population will be divided into two major groups, namely technical and non-technical. On one hand, technical group comprises students from seven engineering faculties, such including Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Geoinformation Science and Engineering, Faculty of Chemical and Natural Resource Engineering, Faculty of Electrical Engineering, Faculty of Science and Faculty of Computer Science and Information System. On the other hand, non-technical group consists of students from three non-engineering faculties, i.e. Faculty of Management and Human Resource Development, Faculty of Education and Faculty of Built Environment. According to Krejcie and Morgan (1970), the sample size needed for a population consists of 6000 cases should be at least 361 cases. Therefore, in this study, the researcher selected 400 final year students from the various faculties. The sample will be selected by using stratified sampling technique to ensure fair representation of the population due to the dominance of certain faculties. Table 1 shows that out of 400 questionnaires sent out, 372 sets were completed and returned thus, the response rate was 93%.

5.2. Measurement and Instrument Development

A set of questionnaire was designed to obtain a comprehensive assessment of final year undergraduate students' perceptions on motivational factors for entrepreneurship and intention to possibly start up own enterprise.

Type and form of questions in a questionnaire will determine the quality of the particular questionnaire (Sekaran, 2003). As stated by Sekaran, closed questions help respondents to make quick decision to choose among the several alternatives before them. This is a study of perceptions or a study on how strongly the respondents agree or disagree with certain statements. According to Sekaran (2003), five point Likert scale is best to be used in this type of study because it is able to elicit responses with regard to the object, event or person studied. As such, the researcher will follow Sekaran's recommendations by using five point Likert scale for the questions.

The questionnaire for the study consists of the following sections: (1) Respondent's demographic; (2) Motivational factors for entrepreneurship; and (3) Intention to possibly start up own enterprise.

Table 1. The number of respondents participated in the study

Faculties	Questionnaires Distributed	Questionnaires Returned
Civil Engineering	52	49
Mechanical Engineering	44	44
Geoinformation Science & Engineering	24	15
Chemical & Natural Resource Engineering	32	29
Electrical Engineering	88	79
Science	28	28
Computer Science & Information System	56	55
Management & HRD	20	20
Education	44	44
Built Environment	12	9
Total	400	372

6. Results of the study

6.1. Respondents' background

The variables included in this section are the demographic backgrounds of the respondents, such as gender, age, ethnic group, field of study, parents' total monthly salary, and whether or not respondents or any of their family members operating own business.

Fig. 2 shows the distribution of respondents by gender. Evidently, there were more male respondents than female respondents. This result reflects the actual distribution of students in UTM, in which there are more male students than female students.

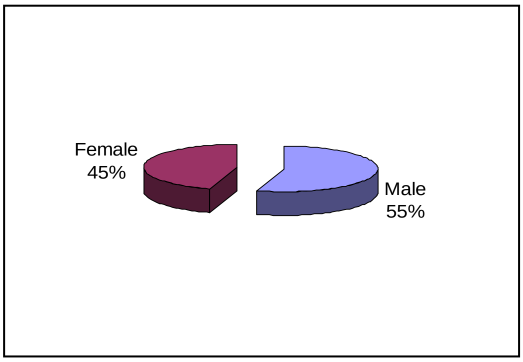


Fig. 2. Distribution of respondents by gender

As for the distribution of ethnic group (Table 2), approximately two third of the respondents were Malay, followed by Chinese and India. There were a small of group of students from other ethnic groups. The finding is similar to that found by Rosli and Juhary (2001) in another university in Malaysia. In addition, the results have also well represented the actual distribution of ethnic group in UTM.

Table 2. Distribution by ethnic group

Ethnicity	Frequency	%	Cumulative Percent
Malay	237	63.7	63.7
Chinese	99	26.6	90.3
India	27	7.3	97.6
Others	9	2.4	100.0
Total	372	100.0	

Table 3 presents the distribution of respondents by field of study. As anticipated, majority of the respondents (approximately 80%) came from technical field. The finding showed that approximately 20% from the total students in UTM were non-technical students thereby reflecting the actual distribution of students by field of study and represented a wide range of respondents' educational backgrounds including technical and non-technical field of study in UTM.

Table 3. Distribution of respondents by filed of study

Field of Study	Frequency	%
Technical :		
Electrical Engineering	79	21.2
Information Technology	55	14.8
Civil Engineering	49	13.2
Mechanical Engineering	44	11.8
Chemical & Natural Resource Engineering	29	7.8
Science	28	7.5
Geoinformation Science & Engineering	15	4.0
Subtotal:	299	80.3
Non-technical :		
Education	44	11.8
Management & HRD	20	5.4
Built Environment	9	2.4
Subtotal:	73	19.6
Total	372	100.0

For the distribution of respondents' parents' total monthly income (Table 4), vast majority of them were in the category of below RM1500. The results indicate that most of the respondents' parents are actually income earners or employees. This is followed by the categories of between RM1500 to RM6000. It is believed that those parents who are in these categories are operating own business as entrepreneurs are normally related to rich, wealthy and draw a high salary (Abdul Aziz, 2001).

Table 4. Parents' monthly salary

Monthly Salary	Frequency	%
Below RM1500	206	55.4
RM1500-RM3000	98	26.3
RM3000-RM4500	36	9.7
RM4500-RM6000	19	5.1
Above RM6000	13	3.5
Total	372	100.0

From Fig. 3, there were a small number of students (less than 6%) currently operating own business. Though the number of student is small, this is encouraging. The finding indicates that there are ample rooms for UTM to promote entrepreneurship among its students, and to train its students to be entrepreneurs. As urged by Dana (2001), promoting entrepreneurship in a developing country like Malaysia should start from small. Thus, the prospect of entrepreneurship in UTM as well as in Malaysia is still quite encouraging.

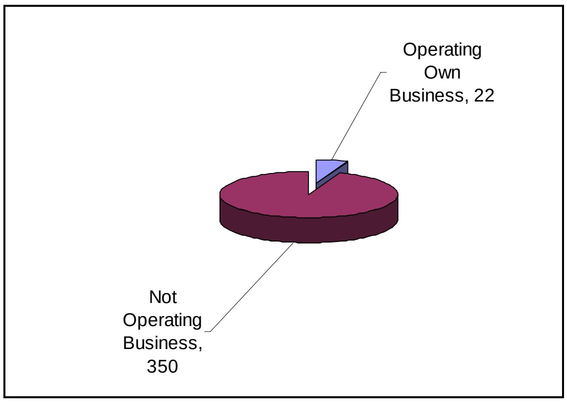


Fig. 3. Currently operating own business

Fig. 4 shows that about one third of the respondents' family member are currently operating own business. The results have strengthened the findings in Table 4, which showed that most of the respondents' parents were actually income earner, with total monthly income less than RM1500.

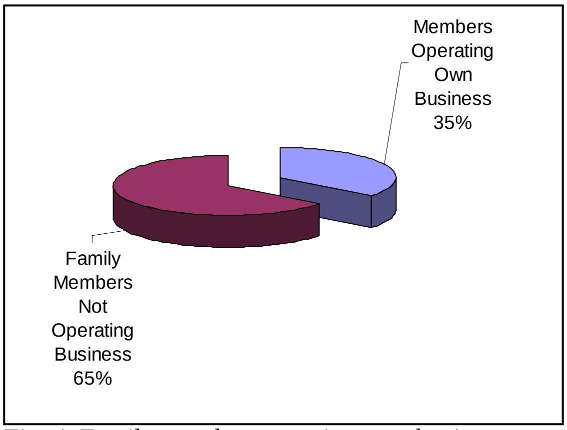
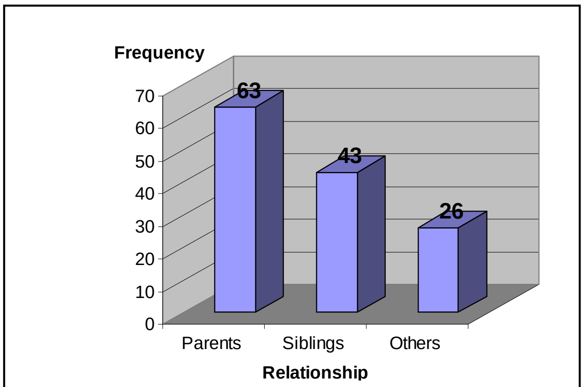


Fig. 4. Family member operating own business

Furthermore, for the students whose parents are operating own business at the moment, extra attention should be given to them as they are the potential entrepreneurs. One possible reason behind this is these students are exposed to better business environment and they have good role model. As supported by various researches, children of entrepreneurs are more likely to become entrepreneurs themselves (Dyers, 1992; Henderson and Robertson, 1999).

Of the 132 respondents whose family member were operating own business (Fig. 5), nearly half of them were respondents' parents, followed by siblings and other relatives, such as uncles or aunties. The finding could be served as a good indicator for promoting entrepreneurship among UTM students. As mentioned by Dyers (1992) and Henderson and Robertson (1999), entrepreneurial families or parents are more likely to produce entrepreneurial kids because of the great demonstrating effect. As mentioned earlier, a good role model could have a great impact on entrepreneurship. Thus, the finding showed that these students possess high potentials to be entrepreneurs, especially to those whose parents are operating own business at the moment.



6.2. Life as a motivational factor for entrepreneurship

The original data is in Likert scale format or ordinal data. Thus, the bivariate analysis such as Mann-Whitney U test will be carried out to determine the differences in motivational level for entrepreneurship based on the respondents' field of study. For this section, students are divided into technical and non-technical groups, items that would motivate the different group of students will be determined.

Six items are included in this section. All items are related to students' life experience, such as early childhood experience and lifestyle, aspirations, special incidents happened in the past, working experience and influences imposed by other entrepreneurs.

Table 5 presents the distribution of means on life experience as a motivational factor for entrepreneurship by respondents' field of study. Based upon the Mann-Whitney U test, out of the six items, one has shown to have significant differences between technical and non-technical students, with P-value of 0.023. As such, non-technical students were more motivated by early childhood lifestyle than non-technical students.

Table 5. Life experience as a motivational factor for entrepreneurship

Motivational Factors	Technical	Non-Technical
Early childhood experience	3.38	3.58
Early childhood lifestyle	3.31**	3.53**
Aspiration to be a businessman	2.68	2.84
Special incidents happened in the past	3.48	3.58
Previous working experience	3.63	3.45
Influenced by other entrepreneurs	3.40	3.34

**** Significant at P=0.05**

According to Dyers (1992), lifestyle such as start work at early age, be independent, enjoy earning money and live in a business environment are some of the typical early childhood lifestyle of many entrepreneurs. Generally, these people prefer business, which measures one's success by financial indicator, and dislike science, which requires numerous of dull and tedious researches to be conducted. It is believed that non-technical students are more exposed to business environment than technical students; and that is one of the possible reasons they opt for non-technical courses. Thus, their early childhood lifestyle seems to play an influencial role in their career choice. Meanwhile, technical students' early childhood lifestyle seems to be more technical based and less business oriented; hence, causes them to opt for technical courses and less motivated by their early childhood experience, if compared to non-technical students.

6.2.1. Differences in entrepreneurship education as a motivational factor for entrepreneurship between technical and non-technical students

Eight items related to entrepreneurship education were taken into account. The items included university programs, entrepreneurship education level, abilities to perform different kind of tasks related to business, and entrepreneurship culture.

Table 6 shows the distribution of means on entrepreneurship education as a motivational factor for entrepreneurship by respondents' field of study. Based upon the Mann-Whitney U test, interestingly, all items recorded a P-value greater than 0.05. Thus, none of the item showed significant differences between technical and non-technical students. Evidently, both technical and non-technical students were equally motivated by the items in entrepreneurship education.

Table 6. Distribution of means on entrepreneurship education as a motivational factor for entrepreneurship by field of study

Entrepreneurship Education	Technical	Non-Technical
University programs	2.85	2.96
Start a job without extra education	2.36	2.53
Familiar with special problems	2.67	2.89
Able to perform business functions	2.74	2.84
Able to perform tasks not within the expertise	2.81	2.89
Able to perform paperwork	2.74	2.88
Having necessary managerial substances	2.62	2.56
Entrepreneurship culture in university	2.57	2.64

Previous researches have proven that entrepreneurship education does affect the students' career choice (Kolvereid and Moen, 1997; Brown, 2000; Klofsten, 2000). The finding supports the previous findings by showing that all students, either from technical or non-technical field, though are not highly exposed to the entrepreneurship education; they are motivated by entrepreneurship education to be an entrepreneur.

Students from different field of study should have different exposure to entrepreneurship education, if possible, it should be custom made and well tailored for different field of studies in order to meet their needs and requirements (Jones-Evans, 1995). For example, technical students should have learnt the proper ways to transform their ideas and innovation into profitable products while non-technical students should have the knowledge of identifying business opportunities and managing businesses. Unfortunately, the learning environment in UTM does not support this view. Entrepreneurship education is not custom made for the students from different field of studies. In other words, all students receive the same level of entrepreneurship education in UTM.

6.2.2. Differences in Environment As A Motivational Factor for Entrepreneurship between Technical and Non-technical Students

Eight items are included in this section. The environment factors include economic, government, market and financial conditions, technological level, communication networks and cultural values.

There were several differences found in the items of environment as a motivational factor for entrepreneurship (Table 7). For instance, significant differences were found on economic conditions, market structure, contacts of network and society acceptance on operating own business. For the above cases, items recorded a P-value that less than 0.05. On one hand, non-technical students were more motivated by economic conditions, market structure and society acceptance on operating own business than technical students. On the other hand, technical students were more motivated by contacts of network.

Table 7. Mean on environment as a motivational factor for entrepreneurship by field of study

Environmental Factors	Technical	Non-Technical
Economic conditions	3.71**	4.01**
Market structure	3.76**	3.99**
Government policies	3.60	3.66
Financial support	2.83	2.68
Current technological development	3.40	3.47
Contacts of network	2.98**	2.66**
Society acceptance on operating own business	3.38**	3.59**
Cultural values of operating own business	3.61	3.73

**** Significant at P=0.05**

Few points noted are: (1) Students from non-technical field, especially those from business and management background have better knowledge and skills in analyzing market conditions as well as national economics performance. Therefore, it is not surprising that these students are more motivated by the economic conditions and market structure in our country. (2) During the venture start-up phase, entrepreneurs require employees, customers and other business counterparts to make their businesses into operations. From the finding in Table 3 there were more students in the technical field than non-technical field. Indirectly, the finding implies that it is easier for technical students to locate their potential employees, customers or even business counterparts, and eventually build up their own contacts of network. (3) As argued in previous section (Table 6), non-technical were mostly originated from business oriented background, thus, their societies highly encourage and accept individuals to operate own business. For non-technical students, due to their educational background, societies expects them to be engineers or scientists, but not as entrepreneurs.

6.2.3. Differences in Personal Characteristics as a Motivational Factor for Entrepreneurship between Technical and Non-technical Students

Six items are included in this section. Items related to students' personal characteristics, includes entrepreneurial behavior and attitude, ambitious, belief, willingness, competency, confidence and business ideas.

Some interesting differences can be noted from Table 8. Based upon the Mann-Whitney U test, significant differences, with P-value less than 0.05 were found on four items. They were ambitious, fully control of life events, prefer to take and hold unmistakable command and P11: Willing to take and learn new things. Apparently, non-technical students were more motivated by ambitious, fully control of life events, prefer to take and hold unmistakable command and willing to take and learn new things than technical students.

Table 8. Distribution of means on personal characteristics as a motivational factor for entrepreneurship

Personal Characteristics	Technical	Non-Technical
Able to behave like an entrepreneur	3.51	3.37
Have strong desire to be successful	4.35	4.26
Ambitious enough	4.37**	4.60**
Sensitive to rewards and punishments	3.86	4.04
Fully control of life events	3.49**	3.75**
Believe in chance, luck or fate	3.85	4.05
Prefer to take and hold unmistakable command	3.54**	3.82**
Able to analyze any uncertainty situations	3.23	3.26
Ready to take challenges and risks	3.51	3.67
Willing to work in an ambiguous situation	3.10	3.12
Willing to take and learn new things	4.06**	4.33**
Confident to achieve goals	4.15	4.19
Competent in performing all kinds of works	3.44	3.60
Have new and unique ideas on business operations	3.24	3.10

**** Significant at P=0.05**

Non-technical students generally possess the characteristics of an entrepreneur. Several vital personal characteristics that an entrepreneur should have are such as to be ambitious, strong need for control, openness to new things and self-confidence (Koh, 1996). Obviously, non-technical students possess the above mentioned characteristics and are more motivated by these items than technical students. The finding is in line with several previous findings which showed that non-technical students actually possess the characteristics of entrepreneurs and are motivated by these characteristics to start own enterprise (Koh, 1996; Maki, 1999).

6.2.4. Intention to Possibly Start Up Own Enterprise

Although technical students (Table 9) has higher intention to possibly start up own enterprise, however the study shows that there is no significant difference between the two group.

Table 9. Mean on intention to possibly start up own enterprise

Description	Technical	Non-Technical
Intention to possibly start up own enterprise	2.93	2.77

Although not all students recorded a very high intention to start up own enterprise, to the very least extent, they are considering to take up entrepreneurship as their career after graduation. Given the results from previous researches that students from various fields of studies were inclined to start their own enterprise, the results comply with the previous studies. Furthermore, the previous sections have also presented the findings that both technical and non-technical students were motivated by the factors such as life experience, entrepreneurship education, environment and personal characteristics to take up entrepreneurship as career. Therefore, the students should have shown their intention to start up own enterprise or business.

7. Conclusion & recommendations

Findings from various researches indicated that the entrepreneurship motivational factors: (1) Life experience; (2) Entrepreneurship education; (3) Environment; and (4) personal characteristics are capable in influencing a person's choice to be entrepreneur. As Henderson and Robertson (1999) pointed out, students from both non-technical and technical background considered life experience as a motivational factor for entrepreneurship among them. However, researches conducted by Kolvereid and Moen (1997), Brown (2000) and Rosli and Juhary (2001) yielded some interesting findings on entrepreneurship education as a motivational factor for entrepreneurship. Unanimously, their findings suggested that entrepreneurship education could only motivate the students from business or non-technical background to pick up entrepreneurship as career. As for the third factor, environment, James and Teo (1995), Bygrave (1997) and Lambing and Kuehl (2000) asserted that individuals would be influenced by environmental factors to decide whether or not to be entrepreneurs. Researchers studied on relationship between personal characteristics and entrepreneurship inclination also agreed that students, both from business and non-business background, are motivated by their personal characteristics to be entrepreneurs (Sinha, 1996; Koh, 1996; Mäki, 1999; Alstete, 2002).

Interestingly, there are some contradictions between the findings in this study and the findings in previous studies. There is no significant difference found in entrepreneurship education as a motivational factor among technical and non-technical students (Table 4.12). Hence, the following conclusion could be made:

> Both technical and non-technical students are motivated by the level of entrepreneurship education and training that they have received for entrepreneurship.

Although this study found contradictions on entrepreneurship education, results on the other three factors: (1) Life experience; (2) Environment; and (3) Personal characteristics supported the past literatures. Some significant differences were found in the items of life experience (one item), environment (four items) and personal characteristics (four items). For each of the above factors, though significant differences were found on some items, the significant differences were not found on most of the items. As such, the following conclusions could be drawn:

> Both technical and non-technical students are motivated by life experience, environment, and personal characteristics for entrepreneurship.

7.1. Differences in intention to possibly start-up own enterprise

Intentions to possibly start-up own enterprise, as emphasized by several researchers, is important to understand the student's interest in their career planning (Koh, 1996; Kolvereid and Moen, 1997). Furthermore, as Maki (1999) pointed out, by understanding the students' intention to possibly start-up own enterprise, the institution could make better adjustment to meet the needs of students. The researchers found out that, on one hand, students from business and social sciences background possess the intention to start up their own business after graduation. On the other hand, they also reveled that technical students, such as engineering and pure science students are also inclined to be entrepreneurs.

Past researches have proven that students, either from technical or non-technical, are intended to start to start-up their own enterprise. The similar findings were found in this study. In other words, the findings supported the previous studies. With a P-value that greater than 0.05 was found, which indicated that no significant differences were found in intention to possibly start-up own enterprise among technical and non-technical students. The following conclusions could be made:

(i) Both technical and non-technical undergraduate students are intended to start-up own enterprise at this very moment.

(ii) Although most of the undergraduate students have not started any business ventures, they are at least considering to start-up one at this very moment. "Considering" refers to that students are having rough ideas or big picture about the enterprise that they want to set-up.

7.2. Recommendations for promoting entrepreneurship

The following recommendations are presented for consideration in promoting entrepreneurship among UTM technical and non-technical undergraduate students:

(i) Inculcate Entrepreneurship culture
The foremost step in promoting entrepreneurship among UTM students is to have an entrepreneurship culture embedded in UTM. Students should be encouraged to start-up their businesses within the campus. For instance, students should be given chances to start-up businesses like food stalls, laundry shops, photocopy shops, sundry shops and others within the campus. As such, the cooperation from university administrative departments plays an important part. University management should provide adequate facilities and infrastructures to encourage entrepreneurship start-up in the campus. Besides managing the business within campus, students could be entrusted with the responsibility of managing businesses beyond the campus. It is believed that the students would gain greater exposure to business

environment by letting them to handle and manage the businesses themselves. Furthermore, having institution like "Entrepreneurs Incubators" could be setup to identify the potential entrepreneurs, provide them with comprehensive entrepreneurship training and support them to be the entrepreneurs.

(ii) Entrepreneurship campaigns
In all incidents, the effects of advertisement are tremendous. Thus, in order to popularize the entrepreneurship concepts among students, events such as campaigns, business games competitions, seminars and talks should not be left out. These activities would act as a medium to provide basic information regarding enterprise start-up. As an example, talks given to students would give students some ideas on what is entrepreneurship, how to be an entrepreneur, where to start from and where to look for help. Definitely, these activities would then inspire the students to be entrepreneurs.

(iii) Provide financial aids
One of the dominant facets of start-up that appears to significantly impact on entrepreneurs, especially the students and school leavers, is the capital constraint. And, in most cases, this is the main factor that hinder individual to opt for entrepreneurship. Thus, university could consider to provide long term or short term loan, with minimum interest, for students who whishes to start up own enterprise at campus level. Moreover, university could seek for collaboration with local financial institutions to provide financial aids to the students who need it, especially for the start-up of businesses beyond the campus.

(iv) Offer entrepreneurship subjects at all faculties
A formal education with special emphasis on entrepreneurship can help to prepare a person starting a business. In fact, entrepreneurship subjects provide the most basic knowledge on entrepreneurship to the students. However, the contents of these subjects should have a multi-dimensional basis. In other words, students should be taught not only on theories, but also practical training. Moreover, if possible, the subjects should be tailored made for students form technical and non-technical backgrounds. For instance, students from engineering and science background should be taught on commercializing their invention and innovation. Meanwhile, students from non-technical background should be exposed to practical business training and business management.

(v) Collaboration with business and industrial community
Support from the business and industrial community is vital in the effort of promoting entrepreneurship among students. University should seek for collaboration with business corporations and entrepreneurs to provide a hands-on experience on business management for students. At the same time, it gives students chances to apply the knowledge that they acquired from university into the real life situations. Most importantly, it shreds lights on the operations of a proper business. Furthermore, students are given chances to interact with business people and entrepreneurs to share their experience and success stories. Thus, this experience would stimulate students to start up their own business and enterprise.

(vi) Intensive entrepreneurship training
Some people may have exposed to the concept of entrepreneurship before, and they, too, possess good ideas on starting a business or enterprise. However, they lack the necessary skills to start and manage a business properly, for example, accounting skills, business computing skills and communication skills, problem solving skills etc. Thus, short courses could be conducted to provide substantial business management skills to the potential entrepreneurs. In addition, it prepares students to face the challenging business world and help students to overcome the problems that they may face in future.

(vii) Consultation and advisory services
With a great number of professional people such as lecturers and professors serving UTM, professional consultation and advisory services on entrepreneurship could be provided to the students. However, the services that provide to the students should at least cover two facets, the pre-enterprise start-up and post-enterprise start-up. The former focuses on helping and assisting the students in setting up the enterprise. It covers the areas such as business plan preparation, strategies build-up, business environment analysis etc. On the other hand, the latter focuses on solutions to day-to-day business problems. It covers the areas such as accountancy, business expansion, product and process improvement etc.

(viii) Concentration on advance science and technology research
As a technical university, there is a need to strengthen the science and technology research conducted within the campus. The main reason of conducting these researches is to facilitate knowledge transfer and spin-off ventures creation. As new products or inventions stand a higher chance to gain bigger

market share and more profit, research should focus on new product or process inventions and the commercialization of the inventions. Therefore, lecturers and students should start companies to commercialize the products from research and development. The products or inventions that are successfully commercialized in the market would then stimulate the students, especially the technical students to be innovative and entrepreneurial. Thus, indirectly, it would encourage students from UTM to be high-technology entrepreneurs in the near future.

(ix) Build-up enterprising behavior among students
Entrepreneurs, though, could be taught through proper education, the most important factor still lies within the students themselves. Entrepreneurs possess the characteristics that are different from the other people. Particularly, people believed that entrepreneurs are hardworking, energetic, low risk-averse, innovative, creative and analytic. Thus, there is really a need to grow these characteristics among the students and to shape them into successful entrepreneurs. However, whether or not the students would develop such entrepreneurial characteristics within themselves still depend heavily on the environment and experience that they are exposed to. Hence, it is important that university should provide an enterprising environment to the students, and assist the students to build up their entrepreneurial behavior.

(x) Alumni's support
Former students from the university should also play a part in developing entrepreneurs among undergraduate students. For instance, for alumni who have started their own business should share their experience with the juniors. They could provide some information about identifying business opportunities, strategies to start up business, environment analysis and problems handling skills. Encouragement from the alumni would be more convincing than from the other external entrepreneurs because alumni are the ones from the same educational background and environment. Thus, it would be easier for the current students to believe that they possess the abilities to be successful entrepreneurs.

(xi) Government effort
Another mean to develop young entrepreneurs in a country could be the government effort. In Malaysia, Ministry of Entrepreneur Development plays a crucial role in developing entrepreneurs. However, most of the efforts done by the ministry were to build an entrepreneurial spirit among working adults, and have neglected the youngsters, especially among the students. Thus, Ministry of Education and Ministry of Higher Learning should take charge of the entrepreneurship development in both lower (primary to secondary education) and higher (undergraduate to post-graduate education) learning institutions. Preferably, the three ministries mentioned above should work together in promoting entrepreneurship because the effort to promote entrepreneurship involves policy making and expertise or knowledge transferring. Ministry of education and Ministry of Higher Learning could set up a policy to encourage the business and enterprise start-up in schools as well as in universities. As for the Ministry of Entrepreneur Development, they could assist the schools and universities in the developing of successful entrepreneurs by providing expertise services such as know-how and advice.

References

1. Abdul Aziz Yusof (2001). *Usahawan dan Keusahawanan: Satu Penilaian.* PJ: Prentice Hall.
2. Alstete, J.W. (2002). On Becoming an Entrepreneur: An Evolving Typology. *International Journal of Entrepreneurial Behavior & Research*. 8(4): 222-234.
3. Bakri Musa (2002). *Malaysia In The Era of Globalization.* NE: Writers Club Press.
4. Bird, B (1989), *Entrepreneurial Behavior*, Scott, Foresman, Glenview, IL and London.
5. Bonnet, H, Quist, J., Hoogwater, D., Spaans, J. and Wehrmann, C. (2006), Teaching sustainable entrepreneurship to engineering students: the case of Delft University of Technology, *European Journal of Engineering Education*, Vol. 31, No. 2, pp. 155–167.
6. Bridge, S., O'Neill, K. and Cromie, S. (1998). *Understanding Enterprise, Entrepreneurship and Small Business.* London: Macmillan Press.
7. Brown, C. (2000). Curriculum for Entrepreneurship Education: A Review. [Internet] *CELCEE Digest.* 00-8. Available from: <http://www.celcee.edu/publications/digest/Dig00-8.html> [Accessed 13 November 2003].
8. Bygrave, W.D. (1997). *The Portable MBA in Entrepreneurship.* 2nd ed. US: John Wiley & Sons.
9. Dana, L.P. (2001). The Entrepreneurship education and Training of Entrepreneurs in Asia. *Education + Training.* 43(8/9): 405-416.
10. Drucker, P. (1985), *Innovation and Entrepreneurship*, New York: Harper Collin Publishers

11. Dyers, W.G. Jr. (1992). *The Entrepreneurial Experience: Confronting Career Dilemmas of The Start-up Executive*. US: Jossey-Bass.
12. Gibb, A.A. (1987). Enterprise Culture: Its Meaning and Implications for Education and Training. *Journal of European Industrial Training*. 11(2): 2-38.
13. Gibb, A.A. (2000) 'Corporate Restructuring and Entrepreneurship: What can large organisations learn from small? *Enterprise and Innovation Management Studies*, No.1.
14. Gross, W. A. (2000), Entrepreneurship Education, *TENDS Proceeding of the Technological Education and National Development Conference "Crossroads of the Millineum"*, Abu Dhabi, United Arab Emirates, pp. 1-13.
15. Habibah Elias and Zaidatol Akmaliah Lope Pihie (1995). Profile of Malaysian Entrepreneurs in Relation to Their Achievement Motivation. *Malaysian Management Review*. 30(4): 25-31.
16. Henderson, R. and Robertson, M. (1999). Who Wants to be an Entrepreneur? Young Adult Attitudes to Entrepreneurship As A Career. *Education + Training*. 41(5): 236-245.
17. Hynes, B. (1996). Entrepreneurship Education and Training: Introducing Entrepreneurship into Non-business Disciplines. *Journal of European Industrial Training*. 20(8): 10-17.
18. James, P.T.F. and Teo, H.A. (1995). Enhancing Entrepreneurial Spirit: A Resolve for University Graduates. *Management Research News*. 18(1/2): 31-49.
19. Jones-Evans, D. (1995). A Typology of Technology-based Entrepreneurs: A model Based on Previous Occupational Background. *International Journal of Entrepreneurial Behaviour & Research.* 1(1): 26-47.
20. Klofsten, M. (2000). Training Entrepreneurship at Universities: A Swedish Case. *Journal of European Industrial Training*. 24(6): 337-344.
21. Koh, H.C. (1996). Testing Hypotheses of Entrepreneurial Characteristics: A Study of Hong Kong MBA Students. *Journal of Managerial Psychology*. 11(3): 12-25.
22. Kolvereid, L. and Moen, Ø. (1997). Entrepreneurship among Business Graduates: Does A Major In Entrepreneurship Make A Difference? *Journal of European Industrial Training*. 21(4): 154-160.
23. Krejcie, R.V. and Morgan, D.W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*. 30: 607-610.
24. Lambing, P and Kuehl, C.R. (2000). *Entrepreneurship*. 2nd ed. NJ: Prentice-Hall.
25. Littunen, H, Storhammar, E, Nenonen, T (1998), "The survival of firms over the critical first 3 years and the local environment", *Entrepreneurship and Regional Development*, Vol. 10 pp.189-202.
26. Mäki, K. (1999). Motivation for Entrepreneurship among Academics. [Internet] *43rd ICSB World Conference Proceedings*. June 20. Available from: <http://www.sbaer.uca.edu/Research/1999/ICSB/99ics078.htm> [Accessed 12 October 2003].
27. Mohamed Ariff and Syarisa Yanti Abubakar (2003). Strengthening Entrepreneurship in Malaysia. [Internet] *Mansfield Foundation 4th US-Japan Dialogue*. April 16. Available from:<http://www.mansfieldfdn.org/programs/program_pdfs/ ent_malaysia.pdf> [Accessed 20 November 2003].
28. Parnell, J.A., Crandall, W. and Menefee, M. (1995). Examining The Impact of Culture on Entrepreneurial Propensity: An Empirical Study of Prospective American and Egyptian Entrepreneurs. *Academy of Entrepreneurship Journal*. 1(1): 39-52.
29. Rosli Mahmood and Juhary Ali (2001). Promoting Entrepreneurship Culture among School Students and University Graduates: A Malaysian Experience. [Internet] *46th ICSB World Conference Proceedings*. June 18. Available from: <http://www.sbaer.uca.edu/Research/2001/ICSB/TRACK%20D.htm> [Accessed 20 November 2003].
30. Rosli Mahmood and Mohmad Amin Mad Idris (2003). Bank Managers' Perceptions of The Characteristics of Successful Entrepreneurs. *Malaysian Management Review*. 38(1): 10-14.
31. Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*. 4th ed. US: John Wiley & Sons.
32. Sinha, T.N. (1996). Human Factors in Entrepreneurship Effectiveness. *The Journal of Entrepreneurship*. 5(1): 23-39.
33. Tibbits, G (1979), Small business management: a normative approach, *Msu Business Topics*, Vol. 4 pp.5-12.
34. Timmons, J.A. (2007). *New Venture Creation: Entrepreneurship for the 21st Century*. New York: McGraw-Hill Education
35. Van Gelderen, M., Bosma, N. and Thurik, R. (2001). Setting Up A Business in The Netherlands: Who Starts, Who Gives Up, Who Is Still Trying. [Internet] *Babson College Frontier Entrepreneurial Research*. Available from: <http://www.babson.edu/entrep/fer/Babson2001/I/IG/IG.htm> [Accessed 13 November 2003].

A Preliminary Report on Employers' Perception of SPACE UTM Graduates

Mohd Azraai Kassim[a] ,Mohd Ismail Abd Aziz [a], Ismail Mohamad [b], Arifah Bahar[b], Rio Sumarni Sharifuddin [c]

[a] School of Professional and Continuing Education, Universiti Teknologi Malaysia
[b] Department of Mathematics, Faculty of Science, Universiti Teknologi Malaysia
[c]Faculty of Education, Universiti Teknologi Malaysia

Abstract

This study is conducted to survey the employer's perception of SPACE graduates. The survey covers the graduate's generic skills as well as their technical skills. It samples employers' views of graduates work performance before and after the graduation. It also reports on employers' perceptions of SPACE graduates workplace performance in relation to other graduates of fulltime undergraduates programmes. The employer's perception survey is divided into three parts namely the general sections that cover generic skills and comparative performance, and a technical section containing specific questions on the technical knowledge of the graduates' area of study. The generic skills questionnaires are based on the seven attributes of UTM graduates. The technical skills questionnaires are designed according to the requirements of the respective professional bodies and programmes objectives. The total number of respondents recorded so far is 188. The preliminary result, which covers the general section, shows that SPACE graduates possess the generic skills required, able to perform their job to their employers' satisfaction and, are at par with their full-time counterpart. The three factors that form the employers' perception on SPACE graduates are interpersonal skills, verbal and written skills in both English language and Bahasa Malaysia.

Keywords: Employers Perception, Generic Skills, Comparative Performance

1. Introduction

The School of Professional and Continuing Education at Universiti Teknologi Malaysia started its part time academic programmes in 1993. Since then it has produced more than 4000 graduates in various engineering disciplines. Another 3000 graduated in other fields such as architecture, education, management science and computer science. Part-time students normally joined SPACE programmes using their Diploma level qualification or its equivalent to satisfy the entry requirements. Most of the students continue working with the same employers before, during and after completing their part-time undergraduate studies through SPACE programmes.

SPACE part time undergraduates programmes are conducted during the weekends and classes are conducted in modular form. Each modules lasts about 6-8 hours. At most two modules are conducted each weekend. Questions are often asked whether students received and managed to learn sufficient skills and knowledge in such learning and teaching environment. This study is conducted to measure the students' performance at workplace after their graduation based on the observation made by their superiors at their workplace. The study began in 2006 and data are still being collected. Currently 188 responds have been received and analyzed.

2. The Survey

2.1. *Objectives of the survey*

The objectives of the survey is to measure the employers' perception of SPACE graduates in terms of their generic skills, technical skills and their performance in comparison to graduates of fulltime programmes.

2.2. *The questionnaires*

The questionnaires are divided into three categories. Part A concerns employers' view of graduates attributes in terms of generic skills. The skills are communication skills (verbal and written English and Bahasa Malaysia), Team Working skills, Adaptability skills, Problem Solving skills,

Life Long Learning skills, Ethics and Integrity and Self Esteem.
Details of generics skills concerned are presented in Table 2.

In part B, the respondents are asked to evaluate SPACE graduates technical skills in relation to their disciplines.

The comparative performance of SPACE graduates in relation to their performance before and after graduations are measured in Part C. Respondents are also requested to compare performance of SPACE graduates with that of full-times graduates. In this preliminary report, results from part A and Part C are presented.

3. Results and Discussion

There are five choices of categories to choose from to measure the specific skills. Those categories are:

1. Very Weak
2. Weak
3. Fair
4. Good
5. Very Good

The Very Weak category implies that graduate do not possess the required skills. The Weak category also implies that graduate do not possess the required skills. The American Heritage Dictionary of the English Language states that fair means ‘moderately good’ or ‘mildly satisfying’ where the same dictionary define ‘moderate’ as ‘within reasonable limits’. With this definition the Fair category implies graduate possess sufficient required skills. The American Heritage Dictionary of the English Language states that good means ‘having positive or desirable qualities’. Thus it is obvious that this category implies that the graduates possess the required skills. The Very Good category implies that graduates possess required skills beyond expectation.

By these definitions the categories of Fair, Good and Very Good are the desirable categories. A high percentage of occurrences for these categories imply graduates possess the required skills. Thus this report present the percentage of graduates in those categories to give impression on the quality of SPACE graduates. Results of this study (Refer Appendix 1) shows that more than 90% of employers rate the graduates’ generic skills as either Fair, Good or Very Good for all 16 generic skills listed in Table 2. In fact 12 of the 16 generic skills showed that 90% of employers rate the graduates’ skills as Good or Very Good which is encouraging.

4. General Views Regarding SPACE Graduates

Table 2: Graduate Work Performance before and after completion of SPACE programme.

	Is satisfactory	Is very satisfactory
Was satisfactory	25 %	44%
Was very satisfactory	1 %	30%

Table 3: Comparative work performance between SPACE graduates and full-time graduate from any university.

Characteristics	Frequency
SPACE graduates not as good as full-time graduates.	5%
SPACE graduates are as good as full-time graduates.	71%
SPACE graduates are better than full-time graduates.	24%

The general perception of employers’ towards SPACE graduates’ work performance is shown in Table 2. Only 137 respondents respond to the work performance of graduates before and after they complete the SPACE program. Out of this respondents 55% said the graduates maintained a satisfactory or very satisfactory work performance and 44% said the graduates improved the work performance from satisfactory to very satisfactory level. The strength of SPACE program can be seen as its ability to maintain satisfactory and very satisfactory work performance before and after completion of SPACE program. Furthermore, the true strength of SPACE program can be seen as its ability to improve the work performance of graduates before and after completion of SPACE program. Thus a combined 99% of employers observing the graduates maintained or improved their satisfactory work performance are successful in fostering workforce development.

A combined 146 out of 153 or 95% of employers said that the work performance of SPACE graduates are either as good as or better than work performance of graduates from the full time program as shown in Table 3. This is an indication that SPACE graduates who went through a different modus operandi of teaching and learning are as good as their full time counterparts.

5. Further Analysis.

In this study we utilized factor analysis to group the generic skills in terms of quality and standards to the employees. A group of generics skills which solicited a similar response from the employer is defined as a Factor. The results obtained are computed using SPSS version 10.0. The following table summarizes the results obtained.

Table 4. Generic skills according to Factors

Var	Generic Skills	F1	F2	F3
CS1	Able to speak English			X
CS2	Able to speak Malay		X	
CS3	Written English			X
CS4	Written Malay		X	
TW1	Teamwork participation	X		
TW2	Interact with colleagues effectively	X		
PS1	Handle problem wisely	X		
PS2	Apply necessary skills to solve job related problems	X		
AD1	Able to work in any situation	X		
AD2	Able to execute instruction given by superior	X		
ET1	Adhere to organization rules and regulation	X		
ET2	Accountability	X		
SE1	Level of positive attitude	X		
SE2	Level of honesty and trustworthiness	X		
LL1	Willingness to participate and contribute in in-house courses/ training programmes	X		
LL2	Willingness to seek new knowledge	X		

Results from Table2 indicate that employers are concerned with three factors. These factors can be described as workplace personality, English communication skills and Bahasa Malaysia communication skills.

5.0 Conclusion

i. Generally SPACE graduates possess the generic skills that are required by an organization.

ii. SPACE graduates also manage to maintain their good performance at work as shown in Table 2 in Appendix IV.

iii. As compared to their full-time counterparts, SPACE graduates perform their job equally good.

iv. There are three aspects of generic skills assessed for SPACE graduates, personality at work, English communication skill and Malay communication skill. Thus it is advisable not to neglect Malay communication skill in lieu of English communication skill.

v. The finding of the survey is hoped to describe the general perspective of employers on SPACE graduates. Hence the bigger the sample size the higher the level of confidence on the validity of the result. Based on marginal error formula (Schaeffer et al, 2006)

$$n \geq \frac{Np(1-p)}{(N-1)D + p(1-p)}$$

where $D = \left(\frac{\text{marginalerror}}{z_{\alpha/2}}\right)^2$ and the number of respondents n=188, maximum marginal error for this study is 5.44% which can be considered small.

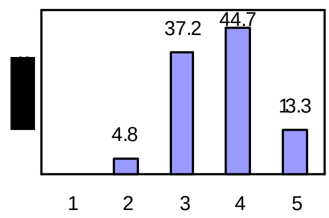
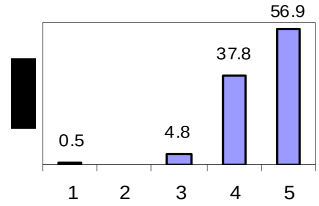
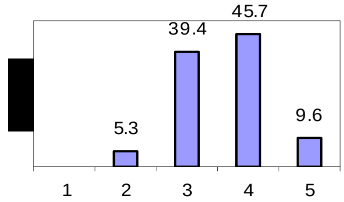
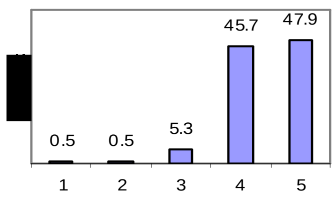
Acknowledgements

References

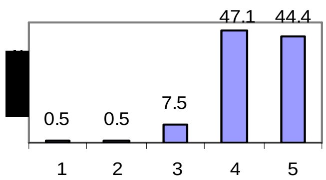
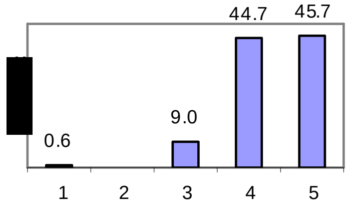
1. Cochran, W.G. (1977) Sampling Techniques, 3rd ed. New York: Wiley.
2. Johnson, R.A. & Wichern, D.W. (2002). Applied Multivariate Statistical Analysis. Fifth edition. Prentice Hall.
3. Koh, W (2000) Executive Summary of the Employer's Survey. Centre for Development of Teaching and Learning.
4. National University of Singapore.
5. Mohd Zaki Kamsah (2005) UTM's Graduate Attributes. CTL.
6. Schaeffer, R.L., Hall, W.M, & Ott, R.L. (2006) Elementary survey sampling, Australia: Thomson Brooks.

APPENDIX

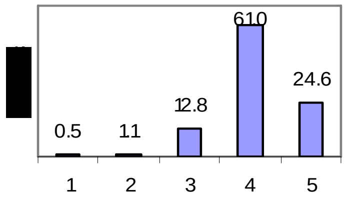
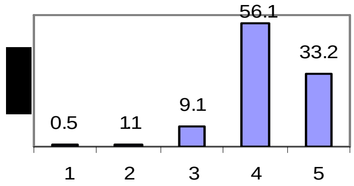
1. COMMUNICATION SKILLS

CS1	*Ability to speak effectively in English.* **(95.2% in Fair, Good and Very Good Categories)**	
CS2	*Ability to speak effectively in Malay.* **(99.5% in Fair, Good and Very Good Categories)**	
CS3	*Ability to write effectively in English.* **(94.7% in Fair, Good and Very Good Categories)**	
CS4	*Ability to write effectively in Malay.* **(99%)**	

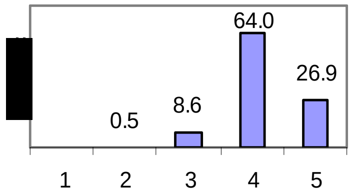
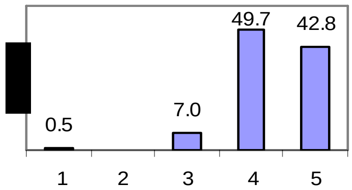
2. TEAMWORK

TW1	*Motivation to participate and assume responsibility to accomplish team objectives.* **(99% in Fair, Good and Very Good Categories)**	
TW2	*Ability to interact effectively among colleagues.* **(99.4% in Fair, Good and Very Good Categories)**	

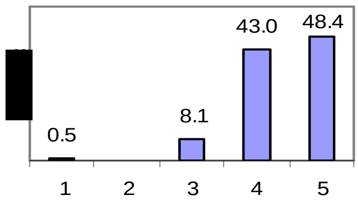
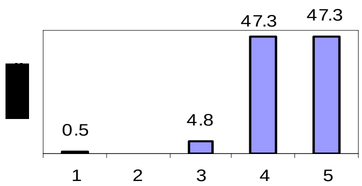
3. PROBLEM SOLVING

<table>
<tr><td>PS1</td><td>Ability to handle problems wisely.
(98.4% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
<tr><td>PS2</td><td>Ability to apply the necessary skills to solve job related problems.
(98.4% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
</table>

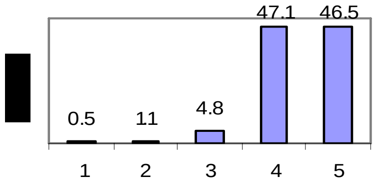
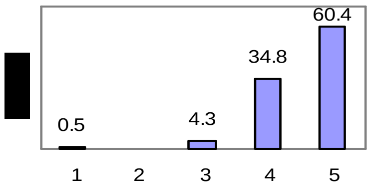
4. ADAPTABILITY

<table>
<tr><td>AD1</td><td>Ability to work efficiently in any situation.
(90.9% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
<tr><td>AD2</td><td>Ability to execute instructions given by his/her immediate superior.
(92.5% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
</table>

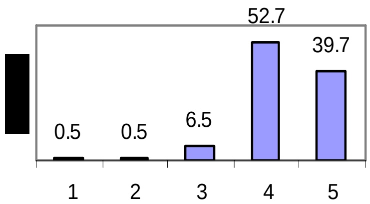
5. ETHICS AND INTEGRITY

<table>
<tr><td>ET1</td><td>Capability to adhere to rules and regulations of the organization.
(91.4% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
<tr><td>ET2</td><td>Capability to be accountable to the given task.
(94.6% in Fair, Good and Very Good Categories)</td><td>
</td></tr>
</table>

6. SELF ESTEEM

SE1	Level of positive attitude. **(93.6% in Fair, Good and Very Good Categories)**	
SE2	Level of honesty and trustworthiness. **(95.2% in Fair, Good and Very Good Categories)**	

7. LIFELONG LEARNING

LL1	Willingness to participate and contribute in the courses / training programmes organized by the organization (enthusiastic). **(92.4% in Fair, Good and Very Good Categories)**	
LL2	Willingness to seek new knowledge and skills. **(90.2% in Fair, Good and Very Good Categories)**