A Comparative Study of Engineering, Medical and Education Students' Soft Skills Achievement in Malaysian Public Higher Education Institutions

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ABSTRACT

This study aims to compare the soft skills achievement of engineering, medical and education students attending Malaysian public Higher Education Institutions (HEIs). A total of 38,296 final year students from the engineering, medical and education faculties were involved in this study. Data on seven soft skills elements – communication, critical thinking and problem solving, leadership, teamwork, moral and professional, life-long learning and information management, and entrepreneurship - collected using Malaysian Soft Skills Scale (My3S) were analysed using both descriptive and inferential statistics. The findings revealed significant

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differences in the scores for all seven soft skill elements among students from the three fields of study with the exception of teamwork skill scores between medical and engineering students. .

Keywords: *Soft skills, engineering student, medical student, education student, Malaysian Soft Skill Scale (My3S)*

BACKGROUND OF THE STUDY

Excellent academic qualification, extensive work experience as well as area of expertise are often perceived as important deciding factors that qualify an individual for selection into the workforce. A review of literature related to graduate attributes reveals most employers tend to search for graduates who in addition to possessing required skills and content knowledge to function at work place also possess the right attitude, are proactive and are willing to learn (Billing, 2007; Ong, Sharma & Heskin, 2007; Crebert et al., 2004). More importantly, graduates ought to be communicatively proficient, have analytic turn of mind, are able to solve problems, can work competently with others, and are flexible (White, 2012; Yorke & Harvey; 2005, Kruss, 2004). In Malaysia, communication, interpersonal, leadership and teamwork skills are among the soft skills emphasized by employers (Ab. Rahim, Shamsiah & Ivan, 2007). More recently, a study by Yuzainee, Azami and Mohd Zaidi (2010) specifically reported the top five "requirement skills" (ranked according to priority) that Malaysian engineering graduates must have for employment purposes are communication, teamwork, professionalism, problem solving and decision making skills, and competency.

The above-mentioned "employability skills" are generic abilities or soft skills cutting across various learning domains encompassing personal aspects and the ability to work in groups. Owing to its importance, the Ministry of Higher Education has identified seven elements of soft skills deemed essential for HEI students (Ministry of Higher Education, 2006). They are communication skills (CS), critical thinking and problem solving skills (CTPS), teamwork skills (TS), moral and professional ethics (EM), leadership skills (LS), life-long learning and information management skills (LL) and entrepreneurial skills (KK). These seven elements are further broken down into 34 sub-elements, 16 of which are categorized as 'must

have' (MH) and the remaining 18 as 'good-to-have' (GH) for students to be considered as competently excellent. A detailed description of the instrument has been reported in an earlier publication entitled "A nationwide comparative study between private and public university students' soft skills" (Abdul Karim et al., 2012).

STATEMENT OF THE PROBLEM

Employers as well as educators frequently complain about the lack of soft skills among graduates from tertiary education institutions. As far back as 40 years ago, the German Engineering Association (VDI) recommended that 20% of the courses offered within the engineering curricula should inculcate soft skills. Ihsen (2003, in Schulz, 2008) pointed out engineering graduates should acquire foreign languages, be culturally aware and sensitive, are team players, and have attended rhetoric courses. Schulz (2008) narrated the story of a German Professor, Dietrich Schwanitz who compared the levels of soft skills between a fictitious newly graduate Mechanical Engineer and a recent graduate of History of Arts. Schwanitz was said to have actually rated the mechanical engineer at the level of a caveman. The British Association of Graduate Recruiters (AGR) and similar agencies also reported that employers tend to find candidates who are seeking employment to be academically proficient but lacking in other aspects of functioning at a work place. Predominantly missing is communication skills. Researchers in the medical field too have lamented that many medication-related errors in hospitals and strained or even damaged patient-doctor relationships are the results of ineffective communication and interpersonal skills (Wright, 2012; Levinson et. al, 2010). Indeed, the situation is a serious concern in the science and engineering programmes.

In Malaysia, discussions on soft skills attainment among university students are similar to those researched in the US, Europe, Africa, Japan and Korea. Across the board, Malaysian employers are far from satisfied with the acquisition of soft skills of Higher Education Institute (HEI) graduates (Hairi et al, 2011; Mohamad Sattar et al., 2009; Singh & Singh, 2008). It is also said that pure science students are found to have better generic abilities compared to their social sciences counterparts, largely due to the fact that they already have the upper hand academic–wise. This study; henceforth, was carried out to answer a number of questions, namely:

1. What is the achievement of all seven elements of soft skills among engineering students?

2. What is the achievement of all seven elements of soft skills among medical students?
3. What is the achievement of all seven elements of soft skills among education students?

4. How different are the achievements of all seven soft skills elements among engineering, medical and education students?

OBJECTIVES OF THE STUDY

This study aimed to compare the soft skills achievement among engineering, medical sciences and education students. Specifically, the objectives of the study were to:

1. evaluate the achievement of all seven elements of soft skills among engineering students;

2. evaluate the achievement of all seven elements of soft skills among medical students;

3. evaluate the achievement of all seven elements of soft skills among education students; and

4. compare the achievement of all seven soft skills elements among engineering, medical and education students.

HYPOTHESES

Seven null hypotheses were put forth to answer the four research questions pertaining to differences in soft skills achievements among engineering, medical and education students.

H_o1 There is no significant difference in the attainment of communication skills (CS) among engineering, medical, and education students.

H_o2 There is no significant difference in the attainment of critical thinking and problem solving (CTPS) skills among engineering, medical, and education students.

H_o3 There is no significant difference in the attainment of teamwork skills (TS) among engineering, medical, and education students.

H_o4 There is no significant difference in the attainment of moral and professional ethics (EM) skills among engineering, medical and education students.

H_o5 There is no significant difference in the attainment of leadership skills (LS) among engineering, medical, and education students.

H_o6 There is no significant difference in the attainment of life-long learning and information management (LLL) skills among engineering, medical, and education students.

H_o7 There is no significant difference in the attainment of entrepreneurship skills (KK) among engineering, medical, and education students.

H_o8 There is no significant difference in the attainment of overall soft skills achievement among engineering, medical, and education students.

METHODOLOGY

This research employed the survey research design. Survey research is one of the most important areas of measurement in applied social sciences, and is roughly divided into two broad areas: questionnaires and interviews. Specifically, this study used the questionnaire known as My3S as the instrument for data collection. My3S has been proven to be significantly valid and reliable. Results from an earlier study during the development of My3S show all items demonstrated alpha value if items less than the standardized item alpha value of .969 were deleted, indicating that all items

are highly significant. The outcomes thus verify all listed items in My3S as sound and significant. Similarly, findings for the content analysis using expert evaluation resulted in the overall content validity coefficient value of .80. In addition to its valid content, My3S items were also found to be reliable whereby the reliability coefficient values using *Cronbach* A*lpha* was .97, Person Reliability (Rasch) was .96, and Item Reliability (Rasch) was1.00.

The My3S was administered to the graduating students of all Malaysian public and private universities during the months of March and April, 2011. A total of 42, 623 students responded out of a graduating population of 55,722 students. This constituted a very high percentage of respondents (76.5%). Out of this total, only 38,296 responses were used for this study (68.7%). These students formed a highly representative sample of the graduating class of 2011. All collected data were analysed using descriptive and inferential statistics. Descriptive statistics used included mean and standard deviation, while inferential statistics included analysis of variance (ANOVA).

RESULTS

The results were reported according to the research objectives of the study, namely by the attainment of soft skills among engineering, medical students, and education students in that order, followed by the comparison of overall soft skills scores. Findings related to the achievement of soft skills for engineering, medical, and education students are as reported in Tables 1-4 while comparisons of soft skills achievement among students of the three fields of study are displayed in Tables 5 and 6.

Soft Skills Achievement among Students

The descriptive analysis (mean and standard deviation) for all seven elements of soft skills among engineering students is as depicted in Table 1. The table evidently shows that the highest score for soft skills element is for CS (M=8.44, SD=.96), followed by LS (M=8.40, SD=1.11) and LL (M=8.30, SD=1.04). Meanwhile, the lowest soft skill score for the engineering students is for CTPS (M=6.91, SD=.98) and the next lowest is KK (M=7.25, SD=1.46), followed by EM (M=7.40, SD=1.47). The overall soft skills achievement for the engineering sample is (M=7.70, SD=.79).

Table 1: Mean and Standard Deviation of Soft Skills Achievement among Engineering Students

Field of Study		CS	CTPS	TS	EM	LS	LL	KK	KI
Engineering	Mean	8.44	6.91	7.50	7.40	8.40	8.30	7.25	7.70
	SD	0.96	0.98	1.18	1.47	1.11	1.04	1.46	0.79

Note: Highest possible score is 10

Meanwhile, findings for the soft skills achievement of medical students are presented in Table 2. The highest soft skills score for the doctors-to-be is for CS (M=8.29, SD=1.04), followed by LS (M=8.22, SD=1.24) and LL (M=8.21, SD=1.09). They are found to be weak in CTPS (M=6.58, SD=.87), KK (M=6.61, SD=1.61) and EM (M=7.74, SD=1.31).The overall mean score for the soft skills achievement of the medical students is 7.58, with a standard deviation (SD) of .83.

Table 2: Mean and Standard Deviation of Soft Skills Achievement among Medical Students

Field of Study		CS	CTPS	TS	EM	LS	LL	KK	KI
Medical	Mean	8.29	6.58	7.50	7.74	8.22	8.21	6.61	7.58
	SD	1.04	0.87	1.16	1.31	1.24	1.09	1.61	0.83

Note: Highest possible score is 10

Table 3 lists the descriptive analysis of soft skills achievement for education students. Based on the table, the education students' strong points are with respect to their LS (M=8.65, SD=1.09), CS (M=8.64, SD=0.93), and LL (M=8.52, SD=0.96) abilities. However, their soft skills score are considerably low for EM (M=7.95, SD=1.11), KK (M=7.07, SD=1.56), and CTPS (M=6.78, SD=0.79). The overall soft skills achievement for the education students is (M=7.93, SD=.77).

Table 3: Mean and Standard Deviation of Soft Skills Achievement among Education Students

Field of Study		CS	CTPS	TS	EM	LS	LL	KK	KI
Education	Mean	8.64	6.78	8.04	7.95	8.65	8.52	7.07	7.93
	SD	0.93	0.79	1.10	1.11	1.09	0.96	1.56	0.77

Note: Highest possible score is 10

The overall descriptive results for all seven elements of soft skills portrayed in Table 4 show the highest score obtained is for CS (M=8.49, SD=0.96), followed by LS (M=8.46, SD=1.12) and LL (M=8.36, SD=1.03) while scores are relatively low for CTPS (M=6.84, SD=0.92), KK (M=7.14, SD=1.51), and EM (M=7.60, SD= 1.37). The respondents' overall soft skills achievement is (M=7.76, SD=0.80).

Table 4: Average Mean and Standard Deviation of Soft Skills Achievement among Students

Field of Study		CS	CTPS	TS	EM	LS	LL	KK	KI
Total	Mean	8.49	6.84	7.67	7.60	8.46	8.36	7.14	7.76
	SD	0.96	0.92	1.18	1.37	1.12	1.03	1.51	0.80

Note: Highest possible score is 10

Differences of Soft-Skills Achievement between Groups

Communication skills

The first null hypothesis states that there is no significant difference in the communication skills (CS) achievement among engineering, medical and education students. Results obtained using one way ANOVA reveals a finding of $\{F(2, 12175) = 73.71, p<.05\}$ (refer Table 5). The findings clearly show the null hypothesis that states there is no significant difference in the communication skills achievement among engineering, medical and education students is rejected. Hence, it is concluded that there is a significant difference in the communication skills achievement among students from the three fields of study. An analysis to find out aspects that contribute to the significantly different findings may be observed via Scheffe Post-Hoc analysis depicted in Table 6. The results clearly show that there exist significant differences in the communication skills between medical and engineering students, medical and education students, and engineering and education students.

Table 5: Results of ANOVA Analysis to See the Differences of Soft-Skills Achievement between Group

Element	Source	Sum of Squares	df	Mean Square	F	Sig.
CS	Between Groups	135.08	2	67.54	73.71	.00*
	Within Groups	11156.38	12175	.92		
	Total	11291.47	12177			
CTPS	Between Groups	116.68	2	58.34	69.72	.00*
	Within Groups	10188.55	12175	.84		
	Total	10305.23	12177			
TS	Between Groups	756.04	2	378.02	284.87	.00*
	Within Groups	16155.91	12175	1.33		
	Total	16911.95	12177			
EM	Between Groups	786.73	2	393.37	215.64	.00*
	Within Groups	22209.53	12175	1.82		
	Total	22996.27	12177			
LS	Between Groups	216.14	2	108.07	86.93	.00*
	Within Groups	15135.01	12175	1.24		
	Total	15351.15	12177			
LL	Between Groups	140.74	2	70.37	67.64	.00*
	Within Groups	12667.47	12175	1.04		
	Total	12808.22	12177			
KK	Between Groups	365.52	2	182.76	80.89	.00*
	Within Groups	27509.46	12175	2.26		
	Total	27874.98	12177			
KI	Between Groups	160.16	2	80.08	128.79	.00*
	Within Groups	7570.12	12175	.62		
	Total	7730.29	12177			

* Significant at α .05.

Critical thinking and problem solving skills

The second null hypothesis states there is no significant difference in the critical thinking and problem solving skills (CTS) achievement among engineering, medical and education students. Results obtained using one way ANOVA reveals a finding of $\{F(2, 12175) = 69.72, p<.05\}$ which

clearly shows that the null hypothesis is rejected (refer to Table 5). In other words, it can be concluded that there is a significant difference in the achievement of critical thinking and problem solving among engineering, medical and education students. The Scheffe Post-Hoc analysis reported in Table 6 reveals significant differences in critical thinking and problem solving ability between medical and engineering students, medical and education students, and engineering and education students.

Table 6: Results of Scheffe Post-Hoc Analysis

Element	Field of Study	Field of Study	Mean Diff. (I-J)	Sig.
CS	Medical	Engineering	-.15	.00*
		Education	-.35	.00*
	Engineering	Medical	.15	.00*
		Education	-.19	.00*
	Education	Medical	.35	.00*
		Engineering	.19	.00*
CTPS	Medical	Engineering	-.33	.00*
		Education	-.20	.00*
	Engineering	Medical	.33	.00*
		Education	.14	.00*
	Education	Medical	.20	.00*
		Engineering	-.14	.00*
TS	Medical	Engineering	.00	1.00
		Education	-.54	.00*
	Engineering	Medical	.00	1.00
		Education	-.54	.00*
	Education	Medical	.54	.00*
		Engineering	.54	.00*
EM	Medical	Engineering	.34	.00*
		Education	-.21	.00*
	Engineering	Medical	-.34	.00*
		Education	-.55	.00*
	Education	Medical	.21	.00*
		Engineering	.55	.00*

LS	Medical	Engineering	-.18	.00*
		Education	-.43	.00*
	Engineering	Medical	.18	.00*
		Education	-.25	.00*
	Education	Medical	.43	.00*
		Engineering	.25	.00*
LL	Medical	Engineering	-.09	.04*
		Education	-.31	.00*
	Engineering	Medical	.09	.04*
		Education	-.22	.00*
	Education	Medical	.31	.00*
		Engineering	.22	.00*
KK	Medical	Engineering	-.64	.00*
		Education	-.47	.00*
	Engineering	Medical	.64	.00*
		Education	.17	.00*
	Education	Medical	.47	.00*
		Engineering	-.17	.00*
KI	Medical	Engineering	-.12	.00*
		Education	-.35	.00*
	Engineering	Medical	.12	.00*
		Education	-.22	.00*
	Education	Medical	.35	.00*
		Engineering	.22	.00*

* Significant at α .05.

Teamwork skills

The third null hypothesis specifies that there is no significant difference in the teamwork skills (TS) achievement among engineering, medical and education students. The findings of one way ANOVA results in Table 5 $\{F(2, 12175) = 284.87, p<.05\}$ indicates that the stated null hypothesis is rejected. In other words, there is a significant difference in the teamwork skills among students from the three stipulated fields of study. The Scheffe Post-Hoc analysis (Table 6) carried out to determine aspects that contribute to any significantly different findings reveals there is a significant difference

in the achievement of teamwork skill between medical and education students, as well as between engineering and education students. However, the achievement for teamwork skills is not significant between medical and engineering students.

Moral and professional ethic skills

The fourth null hypothesis states there is no significant difference in the moral and professional ethics achievement (EM) among engineering, medical and education students. One way ANOVA result reveals a finding of $\{F(2, 12175) = 215.64, p<.05\}$ in Table 5, implying that the null hypothesis is rejected. In other words, it can be concluded that there is a significant difference in the achievement of moral and professional ethic skills among engineering, medical and education students. The Scheffe Post-Hoc analysis (Table 6) specifically shows there exist significant differences in the moral and professional ethics skill between medical and engineering students, between medical and education students, and between engineering and education students.

Leadership skills

The fifth null hypothesis expounds that there is no significant difference in the leadership skills (LS) achievement among engineering, medical and education students. Analysis of one way ANOVA reveals a finding of $\{F(2, 12175) = 86.93, p<.05\}$ (refer Table 5). The finding clearly shows that the earlier stated null hypothesis is rejected. In short, we can conclude that there is a significant difference in the achievement of leadership skills among engineering, medical and education students. The Scheffe Post-Hoc analysis (Table 6) reveals there is a significant difference in the leadership abilities between medical and engineering students, between medical and education students, and between engineering and education students.

Lifelong learning and information management skills

The sixth null hypothesis asserts that there is no significant difference in the lifelong learning and information management skills (LL) achievement among engineering, medical and education students. The findings of one way ANOVA in Table 5 is $\{F(2, 12175) = 67.64, p<.05\}$, attesting the rejection of the null hypothesis. In other words, there is actually a significant difference in the lifelong learning and information management skills achievement amongst the students. The Scheffe Post-Hoc analysis (Table

6) reveals that the lifelong learning and information management skills achievement between medical and engineering students, between medical and education students, as well as between engineering and education students are significantly different.

Entrepreneurship skills

The seventh null hypothesis states there is no significant difference in the entrepreneurship skills (KK) achievement among engineering, medical and education students. Analysis of one way ANOVA indicates $\{F(2, 12175) = 80.89, p<.05\}$ which clearly shows that the stated null hypothesis is rejected (Table 5). It can therefore be concluded that there is a significant difference in the achievement of entrepreneurship skills among the students. The Scheffe Post-Hoc analysis (Table 6) reveals there is a significant difference in the entrepreneurship achievement between medical and engineering students, between medical and education students, and between engineering and education students.

Overall soft skills achievement

One way ANOVA analysis was also carried out to determine if there exists any significant difference in the overall soft skills (KI) achievement among engineering, medical and education students. The result of the analysis in Table 5 is $\{F(2, 12175) = 80.08, p<.05\}$, suggesting that significant differences do exist among the students. The Scheffe Post-Hoc analysis (Table 6) also shows that there is a significant difference in the overall soft skills achievement between medical and engineering students, between medical and education students, and between engineering and education students.

DISCUSSION

All students from the three fields of study were found have high scores for communication skills (CS), leadership skills (LS) and lifelong learning and information management skills (LL). The Education students' mean scores for the three soft skills surpass those of their Engineering and Medical counterparts. As a matter of fact, Education students' mean scores for CS (8.64), LS (8.65) and LL (8.52) also exceeded the overall shared mean value for the three soft skills: CS = 8.49; LS = 8.46 and LL = 8.36 respectively.

The Engineering students' mean scores for all three soft skills elements in turn, are better than the mean scores of the Medical students. Considering the more stringent entrance requirements into the sciences (Engineering, and Medicine) compared to the non-science (Education) academic programmes, it is clear that academic excellence in the form of good grades do not predict communicative capability, leadership ability and lifelong learning and information management know-how.

The contexts in which the students are trained may have possibly contributed to the findings of this study. For the teachers-to-be, the ultimate aim of teaching is not merely limited to transmitting information; they must change students' conceptual understanding via leading and engaging them in meaningful learning activities. They are also made to understand that managing students in varying contexts may be a real handful especially when students are rowdy or inattentive in class; either refuse or fail to listen to instruction and purposely do not abide to school rules. Most teacher education curriculum would expose trainees to a range of activities that they are expected to eventually carry out in schools, amongst which include planning and carrying out lessons, implementing various classroom management strategies and organizing academic and co-curricular activities. As a result, the Education students' CS and LS are greatly enhanced. The teachers-to-be also believe that they are competent in information search and have the ability to manage school-related data.

Similarly, the engineers-to-be are also possibly trained according to industries' expectations. They are expected to be adept in presentations of engineering projects and in convincing the higher management and stakeholders of the course of actions to be taken. Project accomplishment necessitates engineers to ensure that jobs are well coordinated between them and other fellow engineers from varying background and technical expertise. Much of engineers' work scope involves researching information, supervising others and resolving issues at work sites or in the laboratory. The findings herewith are in-line with employers' expectations reported by Yuzainee et. al (2010).

The doctors-to-be are also trained as per required by the industry. Nonetheless, the trainee doctors' lower score for communication in comparison to their teacher and engineer counterparts is probably due to

more emphasis given to developing their critical ability to do the following: identify symptoms, make diagnosis and evaluate prognosis of medical conditions, treat illnesses, attend to minor and major surgical procedures and use medical equipment. Although the ability to communicate well is important, it is perhaps not overtly emphasized since doctors' nature of communication is usually at a more personal level focusing on the medical issue that a certain patient encounters. Furthermore, doctors may not coordinate activities and make others accomplish tasks as extensively as teachers and engineers; their leadership skills (LS) are based on expertise and specialization in a medical area. Doctors' relatively less reliance on other people also provides possible explanation for their low teamwork skills (TS) score.

There are the two elements: critical thinking and problem solving (CTPS) skills and entrepreneurship (KK) skills which all three groups scored the lowest. Low KK scores are not quite surprising since all three academic groups may hold the belief that "entrepreneurship" is merely about marketing or selling of products instead of understanding other aspects of KK which, amongst others, include developing network, sourcing for help if needed, looking for opportunities, taking risks, realising one's dream without having to depend on others, and accomplishing work according to plan. Meanwhile low scores for CTPS suggest that learning activities and classroom instructions perhaps have not been effective to the level where the respondents are confident about their ability to predict events, solve problems, weigh alternatives, and provide justifications for any actions taken. With regard to the relatively low scores that education and engineering students obtained for moral and professional ethics (EM) element, one possible explanation is that students have yet to internalise and personally experience situations that warrant moral judgement and professional ethics considerations such as questioning others' decision, values and culture, bending the rules when need be and owning up one's action and taking the consequences that follow.

RECOMMENDATIONS

The study highlighted a number of implications that HEI instructors and administrators need to address, namely to:

- have more problem- or project-based learning that is contextualized in settings similar to what students will encounter once they join the industry,

- include assessments of and for learning. The nature of assessments needs to vary, tapping into students' cognitive, practical skills and values. The cognitive items must be geared towards promoting analysis, synthesis as well as evaluation of theories, concepts, situations and issues discussed in and out of class,

- show examples of, and provide avenues to inculcate good practices and values that students need to internalize. This could be done through engaging in community services related to the students' fields of study. Examples include health awareness drive and blood donation campaigns by medical students, upgrading or repairing of infrastructure such as bridges, and dilapidated buildings or roads by future engineers, and provision of free tuition by teachers-to-be, and

- collaborate with employers in terms of providing work exposure so that students are well aware of what is expected of them when they apply for a job or when they start working.(Lowden et. al, 2011).

Relevant academic and co-curricular engagements do not only add value to graduating students' knowledge repertoire but also help develop the intended soft skills outlined by the Education Ministry. It is hoped that the above suggestions will help Malaysian HEIs to train and produce graduates who understand their employers' expectations and who are "work-ready" without having to be closely supervised and guided once they report for duty.

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