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Problem Solving Abilities of Malaysian University Students

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Problem solving abilities of college graduates have received considerable attention among employers, university professors and the public at large. Problem solving is a generic skill that needs to be acquired in ensuring success in learning and in the workplace. This study focuses on problem solving abilities of Malaysian university students from the faculties of Engineering, Science, Computer Science, Medicine, Management and Law. A total of 3025 respondents participated in this study. Samples were chosen from seven public universities and two private universities. Data were collected using the Problem Solving Skills Scale (PSSS) component of the Social Problem Solving Inventory (SPSI). The SPSI consists of two major scales, Problem Orientation Scale (POS) and Problem Solving Skills Scale (PSSS). The purpose of this study was to describe the overall problem solving abilities of Malaysian university students, with comparisons made based on year of study and fields of study. There were significant difference between problem solving abilities of (a) final year and first year students, and (b) students from different fields of study.

Problem solving abilities of college graduates have received considerable concern among employers, university professors and the public at large. In Malaysia, the importance of this skill is documented in *Quality Assurance in Public Universities of Malaysia: Code of Practice* (Quality Assurance Division, 2004) that states that the quality of university programs is assessed by the ability of its graduates to carry out their expected roles and responsibilities in society. Among the competencies that students should demonstrate at the end of the program, as stated in the document, are critical thinking, problem solving, creative decision making, ability to communicate, apart from mastery of knowledge in specific fields. Similarly, the United States Department of Labor (1991) also emphasized the importance of developing students' problem solving abilities. The emphasis on problem solving has resulted in efforts to enhance the capabilities of students to solve problems, which include most disciplines and most educational levels (Kulm, 1990; Thomas & Englund, 1990).

The demands of a changing workplace and a complex global society have raised expectations regarding thinking and problem solving among students. College graduates are expected to be able to think critically, take initiatives and responsibilities, devise goals and strategies, and solve problems. Hoenig (2000) cited that a recent survey of 1,000 executives by Caliper Associates, as reported in *The Wall Street Journal*, showed that problem-solving ability is now the most sought-after trait in up-and-coming executives. He further stated that career potential is limited if the individual is not a problem solver.

According to O'Leary (1995), the Business/Higher Education Round Table (B/HERT; 1991) has been pivotal in producing findings relating to both employer requirements and graduate performance in the workforce. O'Leary added that the majority of B/HERT's and related studies (Bradshaw, 1985; Candy & Crebert, 1991; Cooper's & Lybrand, 1991) have found that stakeholder consensus regarding desirable graduate characteristics is fairly consistent. Generic skills such as communication skills, capacity to learn new skills and procedures, decision making and problem solving skills are consistently ranked highly in desirable principal outcomes of undergraduate education. The capacity to solve problem is consistently identified as one of the top three most desirable characteristics of college graduates. Comparable findings were reported by the human resources agency Coopers and Lybrand (1991) when a survey of employers from Queensland business and industry sectors was conducted (O'Leary, 1995). From the perspectives of students, problem solving is also perceived as one of the most valuable skills that they expect to acquire during their university years. In a study conducted at Boise State University (Belcheir, 1996) on what students valued from college education and the extent to which the university have helped them to grow in these areas, the top three skills ranked as most valued by college graduates were written communication skills, oral communication skills, and problem solving skills. The arts, science and business students ranked problem solving as one of the top three, but ordered them slightly differently. The education students ranked it fourth, selecting life long learning as the most important followed by the two communication skills.

Despite the focus on problem solving skill at all levels of education and especially at the university level, research studies (Nickerson, 1994; Kessel, 1996a, 1996b, 1997; Woods et al, 1997) have shown that

university students are not acquiring the skill. Nickerson (1994) stated that educators, researchers, and the business community have long lamented that students are not learning the high level thinking and problem solving skills needed to confront our rapidly changing world and the problems facing society as a whole. This is supported by Woods et al. (1997), in which they found that there was no improvement in problem solving skills among the engineering students during the four-year undergraduate program despite the dedication and efforts of their professors. They further stated that graduating students showed the same inabilities that they had when they started the program. Similar to Woods' findings, Kessell (1996a; 1996b) also found that many undergraduate science and engineering degrees are so packed with facts, technical details and "advanced widget-making" that they do not address adequately such basic issues as creative thinking and problem-solving. Kessell (1997) also noted that students' lack of basic problem solving skills is a frequent complaint heard from teachers, lecturers and especially employers.

Gender differences in problem solving skills have also created interest among researchers. Research with adults indicates that there are gender differences in the skills that men and women use in problem solving (d'Estree & Babbitt, 1998). In a study on Chemistry problem solving, Adigwe (1992) identified higher problem solving achievement among males than among females. However, D'Zurilla, Nezu, and Maydeu-Olivares (1998), in their study on gender differences in problem solving, did not find a main effect for the role of gender as a moderator of social problem solving. The findings pertaining to gender difference in problem solving skills seem inconclusive. Rich and Bonner (2004) stated that no definitive conclusion about gender differences in social problem solving could be made as yet.

Problem solving skill has created interest in researchers and its study has been viewed based on many different theoretical frameworks (Bransford & Stein, 1984; D'Zurilla & Nezu, 2001; Wu, Chester & Dyrenfurth, 1996). Among the different aspects studied are personal problem solving, technological problem solving, and social problem solving. Although ability in problem solving in one's own field of specialization remains the most important characteristic of graduates (Coopers & Lybrand, 1991; Quality Assurance Division, 2004), certain desirable characteristics will be the discriminating factor among college graduates that are applying for a particular position. Employer survey conducted by the University of California, Berkeley (Stasz & Brewer, 2005) suggested that employers are often more concerned about soft skills or attitudes rather than technical knowledge or competencies. Similarly, in Stasz, Ramsey, Eden, Melamid, and Kaganoff (1996) empirical studies of work, it was found that employers and workers feel generic skills, such as problem solving, communication, and the ability to work in teams, are increasingly important for workplace success. These studies have clearly shown the importance of social problem solving, which involves a process by which a person attempts to develop effective or adaptive coping responses to problematic situations. This process includes several cognitive components, such as problem evaluation, seeking response alternatives, and planning (D'Zurilla, Nezu, & Maydeu-Olivares, 1998).

Social Problem Solving

Ritz, et al. (1986) simply defined a problem as a need which must be met. According to Martinez (2005), problem solving is the process of moving towards a goal when the path to that goal is uncertain. The definition is similar to that of Charness (1998), who stated that problem solving is the activity that enables someone to attain a desired state from an initial one in which it is not immediately clear how to reach the desired state. On the other hand, D'Zurilla and Nezu (2001, p. 212) defined problem solving as "the self-directed cognitive-behavioural process by which a person attempts to identify or discover effective and adaptive solutions for specific problems encountered in everyday living." Their definition of problem solving complements their definition of a problem. D'Zurilla, Nezu and Maydeu-Olivares (2004, p. 12) defined a problem as any "life situation or task that demands a response for adaptive functioning but no effective response is immediately apparent or available to person or people confronted with the situation because of the presence of one or more obstacle." Their work focuses on the aspect of problem solving that influences one's adaptive functioning in the real life social environment (D'Zurilla, Nezu, & Maydeu-Olivares, 2004). D'Zurilla and Nezu (1982) refer to the term *social problem solving* as the process of problem solving as it occurs in the the natural environment or real world. Thus the study of social problem solving deals with all types of problems that might affect a person's functioning, including impersonal problems; personal and intrapersonal problems; and interpersonal, community and societal problem (D'Zurilla, Nezu & Maydeu-Olivares, 2004).

Within cognitive social learning theory, effective problem solving is regarded as a skill. Social problem-solving abilities encompass the attitudes and beliefs a person has about problems in general, and the specific problem-solving styles by which a person strategically or ineffectively has to solve problems in everyday life (D'Zurilla, Nezu, & Maydeu-Olivares, 2002; Heppner, Witty, & Dixon, 2004).

This paper discusses problem solving abilities of Malaysian university students. Educational reforms have increasingly focused on critical thinking processes including problem solving (Curriculum Development Center, 2002; Quality Assurance Division, 2004). The latest reform is in response to Malaysia's Vision that by 2020 Malaysia will be a developed country in an era of economic globalization. Identification of problem solving abilities of Malaysian university students who would be the leaders in 2020, is necessary. These students are the product of the educational reforms that have been emplaced. Information on the level of problem solving abilities of students upon admission into a university would be helpful as an indicator of the success of reforms made on the school curricula. Does undergoing the university three-year or four-year curricula develop students into better problem solvers to prepare them to be future leaders? Thus, knowledge on the problem solving abilities of prospective graduates of each university and academic programs would be useful for the university to improve the curricula offered by each university.

Objectives of Study

The objectives of the study were:

1. To identify the problem solving abilities of Malaysian university students; and
2. To determine the problem solving abilities using PSSS subscales based on gender, year of study, and fields of study.

Methodology

This study employs a survey methodology. It was aimed at describing the overall problem solving abilities of Malaysian university students, with comparisons made based on gender, year of study, and fields of study. A total of 3025 respondents from seven public Malaysian universities and two private Malaysian universities participated in the study. The choice of universities was based on the areas of studies offered (i.e., Engineering, Science, Computer Science, Medicine, Management and Law). For each university, certain areas of studies were chosen. For each program involved, faculties were informed of the respondents needed for the study – an equal distribution of students from first year to final year. Fifty respondents were targeted for each subgroup from each university. However, the number of respondents targeted was not met since enrollment in certain programs was much less than 50. Table 1 shows the distribution of respondents by universities.

TABLE 1
Distribution of Respondents by University

University	n
Universiti Putra Malaysia (UPM)	723
Universiti Sains Malaysia (USM)	219
Universiti Teknologi Malaysia(UTM)	179
Universiti Utara Malaysia (UUM)	402
Universiti Kebangsaan Malaysia (UKM)	405
University of Malaya (UM)	209
Universiti Malaysia Sarawak (UMS)	364
Multimedia University (MMU)	248
Universiti Teknologi Petronas (UTP)	276
Total	3025

Instruments

Data were collected using a section of D'Zurilla and Nezu's (1992) Social Problem Solving Inventory (SPSI), described by the authors as a multidimensional measure based on a perspective model of problem solving that characterizes social problem solving as complex, cognitive-affective-behavioral process that consist of different components, including general motivational variables. The SPSI consists of two major scales, a 30 item Problem Orientation Scale (POS) and a 40 item Problem Solving Skills Scale (PSSS), and seven subscales, each with 10 items. Subsumed under POS are the cognition subscale (CS), the emotional subscale (ES) and behavior subscale (BS). Subsumed under PSSS are problem definition and formulation subscale (PDFS), the generation of alternatives subscale (GASS), the decision making subscale (DMS), and the solution implementation and verification subscale (SIVS). The seven subscale structure of the SPSI was formulated based on theory (Sadowski, Moore & Kelley, 1994). Although the social problem solving inventory has been mainly conducted on respondents with negative affective conditions, such as depression, anxiety, stress, suicidal ideation and behavior (Nezu, Wilkins, & Nezu, 2004), the researchers of this study decided that the items of the PSSS can also reflect behavior with regard to university students' problem solving abilities. Therefore, based on the objectives of the study, only the 40 items of the PSSS were administered to the respondents.

The meaning and a sample item of each subscale are demonstrated in Table 2.

The PSSS requires respondents to respond to a 5-point Likert scale from *Not at all true of me* (1) to *Extremely true of me* (5). A pilot test was administered to 56 UPM students. The reliability was found to be high (r = .887). D'Zurilla and Nezu (1992) noted that the SPSI has excellent internal consistency, with alphas of .94 for the POS and SPSI and .92 for the PSSS. The

TABLE 2
Meanings and Examples from the Problem Solving Skills Scale Subscales

PDFS	*Problem Definition And Formulation Scale* refers to the ability to understand the nature of problems, identify obstacles to goals, delineate realistic objectives, and perceive cause-effect relationships. Sample Item: When I have a problem to solve, one of the things I do is analyze the situation and try to identify what obstacles are keeping me from getting what I want.
GASS	*Generation of Alternatives Scale* refers to the ability to brainstorm multiple solution ideas. Sample Item: When I am attempting to find a solution to a problem, I usually try to think of as many different ways to approach the problem as possible.
DMS	*Decision Making Scale* refers to the ability to identify potential consequences, predict the likelihood of such consequences, and conduct a cost-benefit analysis of the desirability of these outcomes. Sample Item: When I am attempting to decide what the best solution to a problem is, I usually try to weigh the consequences of each solution alternative and compare them against each other.
SIVS	*Solution Implementation And Verification Scale* refers to the ability to carry out a solution plan optimally, monitor its effects, troubleshoot if the solution is not effective, and self-reinforce if outcome is satisfactory. Sample Item: After carrying out a solution to a problem, I usually try to analyze what went right and what went wrong.

SPSI also has very good stability, with three-week test-retest correlations of .87 for the SPSI as a whole and .83 and .88 for the POS and PSSS, respectively. The SPSI also has excellent concurrent validity, with significant correlations between the SPSI as a whole and its two major subscales with two other problem-solving measures. The SPSI also has very good construct validity, correlating in predicted ways with several other measures.

Data Analysis

The data analysis included descriptive statistics, a t-test and an ANOVA. The t-test was used to compare students' scores in the problem solving inventory based on gender, while the ANOVA was used to test whether significant differences existed in the problem solving inventory scores between students in different years of study and fields of study.

Findings

In this section, findings of the study are discussed based on the objectives of the study: (a) the problem solving abilities of Malaysian university students and (b) the problem solving abilities in PSSS subscales based on gender, year of study and fields of study.

The Problem Solving Abilities of Malaysian University Students

Respondents' overall scores on the PSSS were used to describe their problem solving abilities. Overall scores were not included if respondents failed to complete all items. Results showed that on a scale of 1 to 5, the mean PSSS scores of each group by universities ranges from 3.32 (SD = .40) to 3.49 (SD = .41; see Table 3). This indicates that problem solving abilities of Malaysian universities students are positive

TABLE 3
Problem Solving Abilities Based on Universities

University	n	Mean	Std. Deviation
UPM	672	3.49	.41
USM	206	3.41	.40
UTM	159	3.41	.42
UNIMAS	343	3.45	.39
UUM	371	3.40	.39
UKM	378	3.38	.41
UM	194	3.42	.42
MMU	208	3.32	.40
UTP	196	3.46	.39
Total	2727	3.43	.41

TABLE 4
T-Test of Scores in PSSS Subscale Based on Gender

Subscale	Gender	N	Mean	SD	t	df	Sig.
PDFS	Male	946	3.60	.57	3.51	2852	.000
	Female	1908	3.52	.54			
DMS	Male	945	3.44	.43	1.03	2840	.304
	Female	1897	3.42	.41			
GASS	Male	942	3.42	.48	3.93	2846	.000
	Female	1906	3.35	.42			
SIVS	Male	947	3.37	.46	.36	2864	.719
	Female	1919	3.36	.46			

and moderate. This is based on the general rule provided by Kubiszyn and Borich (1996) who state that the cut-off point of the mean rating is 3.0 and that scores higher that 3.0 is regarded as positive whilst the contrary is regarded as negative. In addition, according to Nugent, Sieppert, and Hudson (2001) these scores can be conceived as reflecting a magnitude continuum. Higher scores are indicative of greater magnitude and lower scores indicative of lower magnitude. In this study, scores ranging from 3.00 to 4.00 indicated a moderate level of problem solving ability, whilst scores 4.00 to 5.00 indicated high problem solving ability.

Problem Solving Abilities in PSSS Subscales Based On Gender

For each of the PSSS subscales, the score is calculated only if the student responds to all the items in the subscale. Among the four subscales, at most 947 male students and 1919 female students responded to all the items (Table 4). The t-test shows that there is a significant difference ($t = 3.03$, $p < .01$) between the abilities in problem solving of male students ($M = 3.46$, $SD = .42$) as compared to female students ($M = 3.41$, $SD = .40$).

The problem solving ability in PDFS and GASS is significantly different between male and female respondents (see Table 4), indicating that male respondents were better in defining and formulation of problems and in generating alternatives in problem solving, as compared to the female respondents. However, no significant difference was found in DMS and SIVS, indicating that the male and female respondents were equally competent in making decision and in implementing and verifying the solution.

Problem Solving Abilities in PSSS Subscales Based On Year of Study

Respondents were categorized as first year, intermediate, and final year. Based on this categorization, it was found that the final year students obtained the highest score in overall problem solving ability and first year students obtained the lowest (see Table 5).

TABLE 5
Problem Solving Abilities Based on Year of Study

Year	n	Mean	Std. Deviation
First Year	1432	3.40	.41
Intermediate	469	3.42	.41
Final Year	826	3.47	.40
Total	2727	3.43	.41

A one-way ANOVA on respondents' problem solving abilities based on year of study showed that there was a significant difference, $F(2, 2724) = 6.88$, $p < .01$, between the abilities of the three groups of students. Scheffe's test revealed that the ability of final year students was significantly greater than that of first year students. However, no significant difference was found between final year students' ability with that of the intermediate group, nor between the first year and the intermediate. Table 6 shows the PSSS subscale scores based on year of study. Final year students obtained higher scores in all four subscales, PDFS, DMS, GASS and SIVS.

TABLE 6
Problem Solving Abilities in PSSS Subscales Based on Year of Study

PSSS Subscale	Year of Study	n	Mean	Std. Deviation
PDFS	First Year	1487	3.51	.55
	Intermediate	500	3.53	.56
	Final Year	867	3.60	.55
	Total	2854	3.54	.55
DMS	First Year	1489	3.41	.42
	Intermediate	497	3.41	.41
	Final Year	857	3.47	.42
	Total	2843	3.43	.42
GASS	First Year	1485	3.35	.45
	Intermediate	494	3.37	.45
	Final Year	869	3.42	.43
	Total	2848	3.37	.44
SIVS	First Year	1494	3.35	.46
	Intermediate	501	3.35	.46
	Final Year	871	3.40	.46
	Total	2866	3.37	.46

Table 7 shows the ANOVA results of subscale scores based on year of study. There is significant difference in the scores of all four subscales between respondents in different year of study. This shows that final year students are more skilled in defining and formulating problem, in generating alternatives in solving problem, in making decision required during problem solving, and in implementing and verifying the solution to problems, as compared to the first year or the intermediate year students.

Problem Solving Abilities in PSSS Subscales Based On Field of Study

Problem solving abilities were also analyzed based on the respondents' field of study. The field of study is categorized as technical (e.g. engineering, computer science), medical, managerial (e.g. business, accounting), constitutional (e.g., law), and scientific (e.g. chemistry, biology). Table 8 shows that science students obtained the highest scores in the PSSS. However the range of scores in the other fields of study is small.

ANOVA indicates that there is a significant difference, $F(4, 2721) = 5.89$, $p < .01$, in problem solving abilities of respondents based on field of study. Scheffe's test shows that the problem solving abilities of science students are significantly different to that of technical and managerial students.

Table 9 shows the ANOVA results of PSSS subscale scores based on field of study. There is significant difference in scores of all four PSSS subscales between fields of study. Scheffe's test shows that scores in the PDFS of science students are significantly different to that of technical, medical, managerial and law students. Science students also showed a significant difference in the DMS and GASS scores to that of technical and managerial students. Regarding the SIVS scores, only the science and technical students showed a significant difference.

TABLE 7
ANOVA Results - Problem Solving Abilities in PSSS Subscales Based on Year of Study

PSSS Subscale		Sum of Squares	df	Mean Square	F	Sig.
PDFS	Between Groups	4.32	2	2.16	7.11	.001
	Within Group	865.03	2851	.30		
	Total	869.35	2853			
DMS	Between Groups	1.92	2	.96	5.55	.004
	Within Group	490.92	2840	.17		
	Total	492.84	2842			
GASS	Between Groups	2.92	2	1.46	7.43	.001
	Within Group	558.11	2845	.20		
	Total	561.02	2847			
SIVS	Between Groups	1.70	2	.85	3.40	.019
	Within Group	607.96	2863	.21		
	Total	609.66	2865			

TABLE 8
Problem Solving Abilities Based on Fields of Study

Fields	n	Mean	Std. Deviation
Technical	869	3.41	.40
Medical	594	3.45	.41
Managerial	782	3.40	.40
Law	148	3.41	.45
Scientific	333	3.51	.42
Total	2726	3.43	.40

Discussions and Recommendations

This study does not focus on students' ability in solving problems in the context of their area of specialization. Field related problem solving is already over emphasized in all subjects of the students' study program. However, the lesser emphasis tends to be placed on skills in the classroom related to real world problem solving, that is social problem solving skills, which are also critical in ensuring that the respective college graduates is competitive in the job market. Gaining entrance to Malaysian universities, especially public universities, is an honour. Due to the limited number of students that each university can accept, especially in fields such as medicine, engineering and law, only the elite students are able to gain entry. Although Malaysian universities have been very selective in identifying students for a particular program, the moderate performance of university students has been commented on by the Ministry of Higher Education (Ministry of Education, 2004) and the public.

As mentioned earlier, Malaysian university students in the current study fared positively, but moderately, in problem solving ability. The same scenario also tends to apply to other nations (Cotton, 2003; Kessell, 1996a; 1996b; Nickerson, 1994, Woods, 1996). Cotton (2003) emphasized that the need to develop higher order thinking, including problem solving, becomes more critical because the number of students who do not acquire the skill is large, and this gives a great advantage in employability. Although the respondents for this study were selected from critical programs, whose entry requirements are generally higher than most other programs, findings indicated that the students lacked generic skills in problem solving, specifically in definition and formulation of problems, in generation of alternatives subscale, in decision making and in implementation and verification of the solution.

In social problem solving, definition and formulation of problems requires one to understand the nature of problems, identify obstacles to goals, delineate realistic objectives, and perceive cause-effect relationships. This is the first step in the problem solving process. Inability to recognize what the problem wants is a stumbling block in the whole problem solving process. Students that are currently enrolled in the undergraduate programs at Malaysian universities are the outcome of a curriculum reform launched in 1989 (Curriculum Development Centre, 2002). The curriculum sets heavy emphasis on the development of problem solving skill. It can be expected that students who undergo the curriculum would have acquired the skill. However, this study indicates that greater emphasis needs to be done at both the school and higher education level.

Generation of alternatives refers to the ability to brainstorm multiple solution ideas. In the Malaysian context, where education at school level is very exam oriented, it is rather difficult to encourage students to generate alternatives. Once a solution is produced, students would prefer to try other problems for them to gain more exposure in solving a variety of problems. This is viewed as a better strategy in securing good grades. Thus, generation of alternatives is not perceived as widening the learning experience. The practice which eventually becomes a habit could not be

TABLE 9
Problem Solving Abilities in PSSS Subscales Based on Fields of Study

PSSS Subscale		Sum of Squares	df	Mean Square	F	Sig.
PDFS	Between Groups	10.22	4	2.56	8.49	.000
	Within Group	857.99	2849	.30		
	Total	868.22	2853			
DMS	Between Groups	2.49	4	.62	3.60	.006
	Within Group	489.59	2837	.17		
	Total	492.08	2841			
GASS	Between Groups	4.67	4	1.17	5.97	.000
	Within Group	555.69	2843	.20		
	Total	560.36	2847			
SIVS	Between Groups	4.15	4	1.04	4.91	.001
	Within Group	605.03	2861	.21		
	Total	609.19	2865			

changed immediately once they entered the university. However, this study also revealed that final year students obtained significantly higher scores in the problem solving inventory as compared to first year students. This means universities do develop problem solving ability in the students progressively during their three to four years of university education. In comparison, Wu, Custer, and Dyrenfurth's (1996) study involving students from five mid-west public universities in the United States found no significant difference between freshmen (first year students) and seniors (final year students) on the overall problem solving scores, that reflects their personal and technological problem solving abilities.

The findings show that students also lack skill in decision making. As discussed earlier, decision making requires the students to identify potential consequences, predict the likelihood of such consequences, and conduct a cost-benefit analysis of the desirability of these outcomes. It is possible that universities are not substantially focusing on the development of this skill. According to Mincemoyer and Perkins (2003), decision making skills can be taught in a variety of curriculum areas. Mann, Harmoni, and Power (1989) concluded that by age 15, many adolescents have achieved a reasonable degree of decision-making competence. However, adolescents do not consistently apply sound decision-making skills to all decisions, especially when dealing with a stressful or conflict-laden situation. Therefore, scenarios and case studies that require and help build up decision making skills should be incorporated more extensively in university courses.

The findings also showed that students lack skill in implementing and verifying solutions. This skill involves the ability to carry out a solution plan optimally, monitor its effects, troubleshoot if the solution is not effective, and self-reinforce if outcome is satisfactory. As discussed above, relevant case studies and scenarios need to be identified to enhance the development of this skill. Although problem-based-learning has been implemented in various university courses, more effort need to be undertaken to help students build specific skills in problem solving. The emphasis on examinations, especially at the secondary level, has also impeded the development of problem solving skill. As stated by Kessel (1996a, 1996b), courses that are so packed with facts and details would not be able to address adequately issue such as problem solving.

In comparing the ability of male and female students in their problem solving abilities, the findings were contrary to the general performance of Malaysian students, especially at the secondary and tertiary levels. It has been a concern of the Malaysian Ministry of Education, especially when public examination figures showed disparity of achievement between genders, that female students tend to outperform their male counterparts (Ministry of Education, 2004). However, in this study, the male students showed significantly higher scores as compared to the female students in the PSSS. This means that the male students were more able to understand problems and finding effective solutions and ways of coping with their problems. It is possible that female students are better in solving content related problems, and thus perform better in examinations. However, female students might not be able to cope as well as the males in everyday social problems. This can be supported by previous studies (Marcotte, Alain, & Gosselin, 1999; Robichaud et al., 2003) that showed that females have a greater tendency to expect problems to be unsolvable.

Preliminary to the study, it was expected that students from different study programs would differ in their problem solving abilities since each discipline differs in academic training and emphases. Findings showed that the problem solving abilities of science students were significantly higher than that of technical and managerial students. However, their problem solving ability was not significantly different from medical and law students. On the whole, it seems that problem solving ability was more developed among science students. The findings of this study are contrary to that of Wu, Custer, and Dyrenfurth's (1996) study. They found that there were no significant differences among the three majors (technology, engineering and humanities) in the overall personal problem solving scale.

One of the implications of this study is the need to rethink the teaching strategies that can be implemented in universities to foster the development of problem solving skills. Teaching strategies that emphasize collaborative work (see Johnson & Johnson, 1996) and the use of cooperative groups (see Heller et al., 1992; Heller & Hollabaugh, 1992) have been shown to be effective. Other pedagogical approaches, as suggested by Froyd (2003), that facilitate development of problem solving skills are active learning, problem-based learning, project-based learning, discovery learning, inquiry-based learning, and case-based learning. Thus, the traditional lecture method that signifies Malaysian university teaching should be selected only for the delivery of certain content.

In summary, the moderate performance of students in problem solving warrants an immediate and effective solution. Further research needs to be conducted to identify means for enhancing problem solving skill through classroom interaction, for both small and large group classes. Although western literatures (Patrick, 1993; Whimbey & Lochhead, 1999; Taconis, Ferguson-Hessler, & Broekkamp, 2001**)** have identified some effective teaching and learning strategies that could enhance development of problem solving skills, it has

yet to be implemented and tested in Malaysian universities.

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