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Metacognitive Strategies in Promoting the Development of Generic Competences in High TVE in Malaysia

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ABSTRACT

This study focusses on generic competencies that have been considered to be lacking in graduates of Malaysian polytechnics, a crucial type of institution in High Technical and Vocational Education (TVE). Four competencies are highlighted in this study that are considered important in the workplace. They are problem solving, critical thinking, communication skills and team building. This study is aimed at establishing an alternative pedagogical strategy in teaching engineering subjects in polytechnics. As such, metacognitive strategies are proposed in order to consider whether this would enhance students' generic competencies. The study sample consisted of 92 first semester students studying Civil Engineering courses in three polytechnics. The study was constructed utilising both qualitative and quantitative approaches in order to obtain a comprehensive data set. The methods included a survey with two sets of questionnaire and student diaries. Findings from this study showed that after introducing metacognitive strategies, students' ability to master relevant competencies appeared to improve, seen in their active involvement in the learning process. The best contribution of the metacognitive strategies used was in terms of the development of communication and team-building skills. In contrast, problem-solving and critical-thinking skills showed a lower ranking than communication and team-building skills. This could indicate that the application of metacognitive strategies in engineering subjects needs further development. Above all, the study showed that metacognitive strategies helped students to think critically, solve complex problems, write and speak effectively, have respect for others, be able to adapt to change and be ready to engage in life-long learning.

Keywords: Generic competencies, metacognitive strategies, pedagogical strategies

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INTRODUCTION

According to Juri, Wan Abdullah, Zakaria and Darusman (2006), in an era of globalisation and rapid technology changes, life-long learning is a necessity for all. Therefore, the Technical Vocational Education (TVE) sector should develop and upgrade its potential for providing workers who are not only knowledgeable, but who are also skilful and able to adapt to the demands of their job. This is supported by Sipon (2003), who believes that one of the main challenges for TVE is to provide graduates who are able to demonstrate professional competencies as well as possess academic qualification. In simple terms, qualification is a grade on a piece of paper, while competence is what is demonstrated in the workplace.

Malaysian polytechnics, as one group of High TVE institutions, are actively utilising specific strategies to prepare their graduates for employment situations that call for qualified and competent employees, with a proper attitude to work. It is recognised to an increasing degree that a well-rounded educated individual also needs to have cultivated the correct attitudes to work, as well as to be in possession of the competencies to perform particular tasks in the workplace. To fulfil this need for competent workers, Sipon (2003) suggested that technical content should be included with "competencies in planning, design and communication, methods of problem solving, teamwork and social networking" (p. 4). Hence, theoretical knowledge and practice, as well as learning and working, have to be integrated. The more traditional ways of teaching and learning that separate theoretical knowledge from practical aspects should merge these two aspects.

TVE subjects differ from core academic subjects that have traditionally had a strong theoretical emphasis, as the content is more relevant to the world of work. The TVE curriculum and teaching methodology, in theory, focusses on students' interest in tasks that have direct relevance to real-world practices (Ministry of Education [MOE], 2004). Teachers and students of polytechnic programmes are diverse with different backgrounds, academic achievements, skills and expectations. Thus, there is a need to incorporate elements of generic competencies into pedagogical content at the polytechnic level to help students acquire the necessary skills. It is important to integrate theoretical knowledge and practice, as well as to relate to learning and the working environment (Sipon, 2003). In the traditional way of teaching and learning that separates theoretical knowledge from practical aspects, a merger of these is unlikely to take place. There is a need, therefore, to narrow the gap between the education system and the workplace, and the aim should be to help students understand and face the variety of issues and challenges they will meet in their future working lives.

This study is, therefore, important as a means to establishing alternative pedagogical strategies, which are metacognitive strategies for teaching engineering subjects at the polytechnic level. The approach is expected to help students improve their learning and to achieve a deeper understanding of

their subjects. It will also emphasise the positive impacts of a wide range of generic competencies that are critically needed in today's workplace, specifically in the areas of communication, problem-solving, critical thinking and team building.

The Need for Generic Competencies

Malaysia is rapidly moving towards becoming an economically developed nation, with 'Vision 2020' highlighting the principal industrial and developmental aims that the government wishes to achieve by 2020. With a vision of becoming an industrialised nation by 2020, it is considered that Malaysia must be prepared to develop a well-educated, skilled and competitive workforce (Mustapha & Abdullah, 2001). From the perspective of education, this entails educating a highly-skilled and multi-skilled workforce, consisting of individuals who will have global mobility and who should be highly competitive, flexible and independent as well as critical thinkers who are able to use their knowledge as a commodity to survive within a context of intense global competition (Sipon, 2003).

According to the National Centre for Vocational Education Research (NCVER, 2003), there is high demand for generic competencies in the workplace. Employers seek to ensure business success by recruiting and training employees who have a variety of skills and personal attributes as well as technical skills. Proficiency in the broad range of competencies has become the main requirement for the modern worker (NCVER, 2003). Therefore, all education sectors, specifically the TVE system, have a role to play in providing sufficient competencies to students. While TVE has made significant progress to meet workforce demands, further efforts need to be made to improve employability skills of students as required by employers. Teaching and learning strategies employed in TVE and training have not been able to equip students with adequate competencies to enter the job market (Bakar & Hanafi, 2007).

Generic competencies are increasingly important for economic development. Therefore, a more expansive education system is needed, with students taking responsibility for their own learning in order to achieve a more generically skilled workforce capable of adapting to changing technologies and work demands (Abu Hassan & NaviBax, 2003).

The curriculum in TVE and training should include both technical skills and social factors to provide students with the balanced competencies that can influence their future work (Wu, 2003). Providing persons with general competency is the main focus of this study, rather than the specific, narrow competencies required for success in a given occupation. The generic competencies highlighted in this study include the ability to work with others, good communication skills, problem solving and thinking critically, which are equally important for academic success as they are to workplace success.

Metacognitive Strategies and Its Benefits for Successful Learning

The study of metacognition is generally attributed to John Flavell. The term metacognition as proposed by Flavell (1979) is used to refer to the awareness (consciousness), monitoring (controlling) and regulating (reflection or evaluation) of one's cognitive processes. The first serious discussion and analysis of metacognition on mental operations emerged during the middle and late 1970s. The term metacognition itself consists primarily of an understanding of the ways different factors act and interact to affect the course and outcome of cognitive enterprises (Flavell, 1979). In Malaysia, the emphasis on cognition and metacognition can be traced back to the late 1980s, with emphases on critical and creative thinking, which were supposed to be hallmarks of secondary education provision at the time. Metacognition is an important concept in cognitive theory. It includes self-reflection, self-responsibility and initiative, as well as goal setting and time management (Subramaniam, 2009). Therefore, attention should be given to incorporate this strategy into the teaching and learning process.

Metacognitive refers to an organising cognitive principle through which individual cognitive processes are controlled. Metacognitive components consist of self-awareness, monitoring and evaluating; these components can enhance a student's ability to be a better problem solver. Mental operations direct the cognitive function of a person and support problem solvers during the solution process, improving the person's ability to achieve a goal (Mevarech & Kapa, 1996). Mazzoni and Nelson (2000) refer to the term 'metacognition' as being the knowledge concerning one's own cognitive processes and products or anything related to them. There are three main processes involved in the metacognition system namely, awareness, monitoring and regulating, all of which function to aid understanding, as shown in Figure 1.

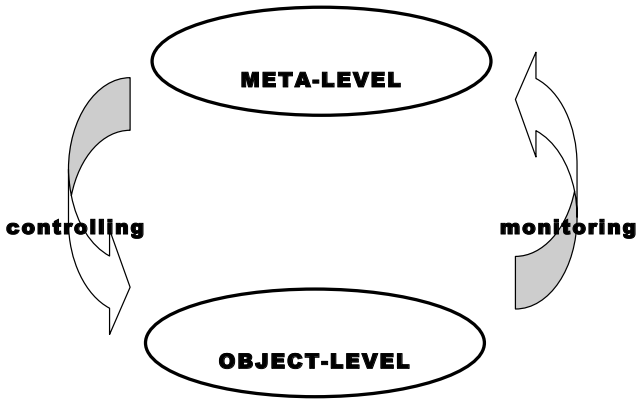

Figure 1. System view of metacognition (Nelson & Narens, 1990, p. 126)

Figure 1 shows metacognition as the interplay between an object-level system and a meta-level system. Metacognition is perceived as the dynamic interaction between object-level and meta-level information flow (Nelson & Narens, 1990). In this way, metacognition can be construed as a supervisory system that enables top-down control of information processing. This model could be useful for understanding and conceptualising the components of metacognitive strategies that could be applied in the learning process and also the role of consciousness and the restructuring of memory while solving a problem.

The benefits of the metacognitive teaching strategy lie in its enhancement of the ability to transfer responsibility for monitoring learning from teachers to students and in promoting positive self-perception and motivation among students (Phelps, Graham, & Kerr, 2004). A metacognitive system also facilitates the planning, reflection and self-evaluation of students, making them less dependent on the teacher's guidance. The metacognitive system assists students in becoming more aware of their current attitudes towards learning goals. In this study, metacognitive strategies refer to the actual processes and strategies that guide the student in how to think about a particular problem, what the student knows about his or her cognition and, above all, the student's ability to control these cognitions.

As a teaching approach, metacognition has a number of inherent advantages that could greatly enhance teaching and learning. Some of its obvious advantages, such as the ability to transfer the responsibility of monitoring learning from the teacher to the student, are well chronicled by Phelps, Graham and Kerr (2004). Other advantages lie in the promotion of self-esteem and self-efficacy as students take control of their own learning. As students take greater responsibility for their own learning, there is the possibility of the development of more lasting learning states in the students that could benefit the students in their future working life. It thus becomes essential that useful metacognitive approaches to teaching need to be supplemented and complemented by equally useful learning approaches that could produce a platform through which individual metacognitive processes could be given full expression.

RESEARCH METHOD AND INSTRUMENTATION

The study employed the case-study approach with a small-scale quasi-experimental design. There are various data collection methods and instruments for qualitative and quantitative approaches. To identify the benefits of the metacognitive strategy on generic competencies, a pre- and post-questionnaire were given to students, who completed them anonymously.

Ten questions were asked in relation to students' experience of learning, with both traditional and metacognitive strategies. The questions examined how those strategies influenced the students' choice of learning practice and how it helped them to actively participate in their learning. Both pre- and

post-questionnaires were constructed with the same questions. The same questions were asked with the purpose of identifying any differences in the feedback obtained between previous approaches (traditional approaches) and metacognitive strategies. The students were asked to rate their preferences using a 5-point Likert scale, with options for 'Strongly Agree', 'Agree', 'Not sure', 'Disagree' and 'Strongly Disagree', with 1 indicating least agreement and 5, most.

During the intervention process, the students were also asked to reflect on their learning experience in a log sheet (diary). The log sheet was formulated with the aim of recording their observations, reactions and perceptions to help to obtain a systematic record of their reflections on the learning process. In this sheet, questions were constructed in a structured form to focus on the topic under study, which required students to provide a rating based on a 4-point Likert scale ranging from Low (1) to High (4). This question was asked at the end of every learning session for every task.

The population of this research comprised 92 first semester Civil Engineering students in Malaysian polytechnics. Only three polytechnics were chosen. They were located in three different areas. The selection of each polytechnic depended on the year in which the polytechnic was founded (the year of operation) and its geographical location. The selection of the sample was achieved using stratified purposive sampling. The course moderator helped in identifying the respondents who were available for participation in the research.

The new intervention teaching approach, metacognitive strategies, was introduced to the students after they had completed the pre-questionnaire. The intervention process took over six weeks to complete. Five learning activities of those designed referred to the Bloom's Taxonomy level of thinking. Task 1 was required for the lower level of thinking, knowledge, while Task 5 was for the highest level, synthesis and evaluation. During the intervention process, the students' diary (the log sheet) was used to obtain their perspectives of the learning process and to determine how the new approach might help to increase their generic competencies. After completing the intervention within the six-week period given to complete the investigation, a second set of questionnaires was given to the students to get a better understanding of the new approach, metacognitive strategies. After completing the treatment, students were allowed to revert to their regular classroom structure and continued learning using their regular classroom practices.

RESULTS

The collated data were useful in evaluating the effectiveness of metacognitive strategies in helping students with their learning. Findings from both pre- and post-questionnaires were shown in Table 1. The pre-questionnaire focussed on traditional approaches, while the post-questionnaire referred metacognitive strategies.

Table 1
Descriptive statistics of traditional approaches and metacognitive strategies

		Traditional Approaches		Metacognitive Strategies	
		M	SD	M	SD
Communication and team-building skills					
1.	Comfortable doing any learning tasks in a group rather than individually	2.330	0.692	3.350	0.582
2.	Will accept and respect opinions and contributions from friends	2.796	0.878	3.370	0.590
3.	Will be able to be a good leader	2.660	0.823	3.350	0.663
4.	Will have no problem in terms of ability to communicate well with other group members	2.524	0.827	3.260	0.451
Critical thinking and problem-solving skills					
5.	Try to relate everything that has been learnt to existing knowledge	2.544	0.872	3.010	0.638
6.	Can solve a given problem without help from the lecturer	2.534	0.838	3.070	0.676
7.	Able to accomplish a task in a given time	2.718	0.912	3.160	0.774
8.	Have the initiative to understand a taught lesson without reliance on the lecturer's notes	2.679	0.782	2.680	0.678
9.	Likes to explore and simplify the taught lesson in own way	2.961	0.816	3.170	0.567
10.	Do revision by referring to many sources	3.000	0.863	3.160	0.560

Table 1 shows, in general, different mean scores between traditional approaches and metacognitive strategies. Obviously, the pattern for all the items suggests that the metacognitive strategies provided higher mean scores than did the traditional strategies. To summarise, the overall findings showed that, in general, communication and team work seemed to have been improved through the hybrid learning environment. On the other hand, students' critical-thinking and problem-solving skills displayed rather different mean values. Major differences were found in terms of competencies regarding working independently (item 6). Students, in general, were able to solve the given task that was assigned to them but although the scores with regards to students' abilities to complete any task in the given time, as well as to plan and organise systematically were high, they, nonetheless, felt it was important to have assistance from the lecturer to successfully solve the task.

The t-test Paired Sample Statistics method was then used to compare the different modes of learning and to confirm if there were statistical differences between the metacognitive strategies and the traditional approaches. Results were obtained as shown in Table 2.

Table 2
Paired samples statistics and paired sample test for the metacognitive strategies and traditional approaches

Paired Samples Statistics								
	Mean	N		Std. Deviation		Std. Error Mean		
Pair 1 Metacognitive Strategies	3.036	92		0.437		0.044		
Traditional Approaches	2.661	92		0.506		0.051		
	Paired Differences			95% Confidence Interval				
	Mean	Std. Dev.	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Paired Samples Test								
Pair 1 Metacognitive Strategies – Traditional Approaches	0.375	0.639	0.064	0.248	0.502	5.868	99	0.000

Table 2 shows that the mean score for the metacognitive strategies, M=3.036, SD=0.437, was different statistically and significantly (t=5.868, 2-tailed value, ρ=0.000) from that of the traditional approaches (M=2.661, SD=0.506). This result tells us that the metacognitive strategies were significantly different when compared with the more traditional approaches, with the difference between pairs being M=0.375. This indicated that the metacognitive strategies, rather than the traditional approaches, were able to help students improve their generic competencies.

DISCUSSION AND CONCLUSION

A study by Martinez, Weigel and Collins (2007) contended that the ability to learn and understand is considered one of the important competencies required by many types of employment in all employees, whether they are self-employed or work in the private or public sector. Results from this study suggested that metacognitive strategies are able to help students to systematically improve their own learning practices. It was apparent from these findings that all the students agreed that they were committed towards their learning and had the ability to administer their own learning in ways to improve and develop the level of generic competencies.

Of the four generic competencies (communication, critical thinking, problem solving and team building), communication and team building skills appear to be the most affected in this study. Students from all three polytechnics agreed that the strategy helped them to improve in these two key skills. The other two competencies (problem solving and critical thinking) could perhaps

have been expected to be the main two competencies to improve. These were improved, but not to such a marked extent. Metacognitive strategies have the additional benefit of promoting life-long learning. This skill also appeared to be well developed among the students.

The most important finding was that the metacognitive strategies helped students to be more independent in their learning when they were directly involved in the process. The students indicated that the new strategy helped them to become more aware and independent of their learning and to be more responsible for their own learning. This finding suggests that students would be able to learn more independently and become more aware of their own learning if they were guided with a good teaching strategy that could help them in handling tasks in their future work.

To summarise, the overall findings indicated that students were able to manipulate existing knowledge and develop more lasting knowledge that might be very useful for application in the workplace of the future. The students indeed showed that they possessed sufficient skills that could boost their employability.

The metacognitive strategies introduced in this study did at least introduce the students to generic competencies related to working experience, and the students had the opportunity to experience and develop those competencies. Therefore, it is hoped that this learning mode is introduced in polytechnics to prepare students for real-life situations and to provide them opportunities for optimal intellectual and academic development as well as the development of generic competencies relevant to the workplace of the 21st century.

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