Supporting Self-regulated Learning and Constructive Alignment in the Teaching of Engineering Mathematics 3

Roselainy Abdul Rahman
Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
lainy@ic.utm.my

Sabariah Baharun
Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
drsabariah@ic.utm.my

Yudariah Mohamad Yusof
Universiti Teknologi Malaysia, Johor Bahru, Malaysia
yudariah@utm.my

Sharifah Alwiah Abdur Rahman
Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
shalwiah@ic.utm.my

ABSTRACT

Purpose: *To report on strategies implemented with objectives of (i) enhancing students' understanding; (ii) supporting self-regulated learning; and (iii) improving teaching practice for Engineering Mathematics 3.*

Design/Methodology: *To support the realization of the KES approach (Knowledge – Experiential – Self-regulated), the team uses a framework which they had previously developed (Roselainy et al, 2012a) to encourage students to adopt self-regulated learning behaviour in an active learning environment. We also ensured that the teaching, learning and assessment activities were constructively aligned (Biggs & Tang, 2010). An action research methodology was implemented to improve teaching practice and thus data collected was used to modify subsequent teaching and learning activities.*

Findings: *The strategies were successful in encouraging and supporting students to embrace and take charge of their own learning. Students' results were also better than their previous achievements in Engineering Mathematics 2 (Differential Equations).*

Conclusions: *Students have to be supported in an appropriately designed learning environment for successful independent learning.*

Research limitations/implications: *Although our students were more accustomed to using 'drill & practise' methods in prior learning, we have shown that they are are able to adopt better learning behaviour if supported in teaching, learning and assessment activities.*

Practical implications: *Independent learning , it is important to that content development and delivery, design of learning tasks and activities as well as assessment are aligned constructively towards the said objective.*

Value: *To improve teaching practice and as evidence that cognitive development and learning behaviour can be modified through appropriate mediation.*

Keywords: *Constructive alignment, independent learning, engineering education*

INTRODUCTION

An important outcome in the teaching and learning of mathematics for Malaysian engineering undergraduates is that they should be able to apply mathematical knowledge that they have learnt to solve complex problems (EAC, 2012). However, research and our experience, has shown that some students will have difficulties in manipulating concepts, coordinating multiple procedures, manipulating symbols in a flexible way and in answering non-routine questions (Tall & Razali, 1993; Anthony, 2000; Croft & Ward, 2001; Hoch & Dreyfus, 2005, Roselainy, 2009, Roselainy, Yudariah & Sabariah, 2012a). Thus, in an effort to promote holistic students' achievement, Malaysia-Japan International Institute of Technology, has adopted a teaching and learning culture focusing on Knowledge, Experiential and Self-regulated learning (KES) as well as supporting development of their soft skills. Malaysia-Japan International Institute of Technology is a government to government initiative that aims to provide Japanese style education in a Malaysian setting. This paper will discuss the strategies implemented in our Engineering Mathematics 3 (Multivariable and Vector Calculus) course that will promote self-regulated learning and awareness of mathematical thinking. To ensure the achievement of the course learning outcomes, we use constructive alignment (Biggs & Tang, 2010) that will ensure outcomes, teaching and learning activities, and the assessment of students' learning will be effective.

In our earlier work, we have developed a framework to support and enhanced students' awareness of their own mathematical thinking powers and emphasised teamwork, independent learning and communication skills. The framework is described elsewhere in greater detail, (Roselainy et al, 2007; Baharun et al, 2008; Roselainy, 2009; Roselainy et al, 2012a). Various theoretical inputs were considered (Mason et al, 1982, 2010; Watson & Mason, 1998; Tall, 1991, 1995) and strategies were developed that was used to make the thinking processes, structures of mathematics explicit as well as increase students' awareness of their own thinking powers. Appropriate teaching tasks were designed aimed at supporting, developing and extending students' own powers in working on mathematical problem solving. In an effort to support students' awareness and develop skills for Self-Regulated Learning (SRL), we adapted our framework and included additional strategies in terms of teaching and learning activities and assessment tasks. This paper will discuss (i) strategies that were used in the class and (2) the study and its findings.

SUPPORTING SELF-REGULATED LEARNING

Self-regulated Learning (SRL) is considered as an important predictor of student academic achievement. In SRL, students should demonstrate abilities to independently plan, monitor, and assess their learning, that is, to take charge and be in charge of their own learning. However, many students need to learn and develop their skills to be able to do this well. Research findings indicated that SRL can help students create better learning habits and strengthen their study skills (Wolters, 2011); apply learning strategies to enhance academic outcomes (Harris, Friedlander, Sadler, Frizzelle, & Graham, 2005); monitor their performance (Harris et al., 2005), and evaluate their academic progress (De Bruin, Thiede & Camp, 2001). Factors that can influence learners' ability to self-regulate were identified through research and our experience. In our previous work (Roselainy, 2009; Roselainy et al, 2012b), we identified factors that influence students' learning behavior. Some of these factors were, beliefs about how to study for mathematics, learning habits endorsed and supported by their previous pre-university experience, rewards, motivation and dependency on teachers' guidance and advice. However, we also saw that factors such as motivation and rapport with lecturers as having significant influence on students' awareness and desire to change their learning behaviour. These factors were also considered when we were designing our activities and tasks.

SRL is defined by students' ability to manage their thoughts, behaviours and emotions to take charge of their learning. A popular model identifies three phases of SRL, *Forethought and planning*, *Performance monitoring*, and *Reflections on performance* (Pintrich & Zusho, 2002; Zimmerman, 2000). In our class, we are aware that our students are in a situation that is transitional in the sense that they have to learn to develop higher order thinking skills to cope with their tertiary studies and this also applies in the learning of engineering mathematics. Thus, some support is provided to help them become more aware of SRL processes and to encourage them to adopt SRL behavior.

First, we will describe the teaching and learning situation which is illustrated below (Figure 1). Our focus of teaching and learning is on the development of knowledge, awareness of mathematical thinking and problem solving as well as soft skills such as communication, teamwork and lifelong learning. The teaching and learning activities is presented using many of the collaborative and active learning strategies so that students learn to use SRL processes. Some of the strategies are described below.

1) Knowledge and mathematical thinking development

i. **Structure of a topic**: Topics are developed to make explicit structures in the mathematical concepts (definitions, facts, theorems, properties, techniques, examples, etc) and the mathematical powers used (specializing, generalizing, conjecturing, characterizing, organizing, reasoning, etc). The tasks are designed to encourage students to be aware of how and when the mathematical thinking powers are used and their connection to the topics are made explicit.

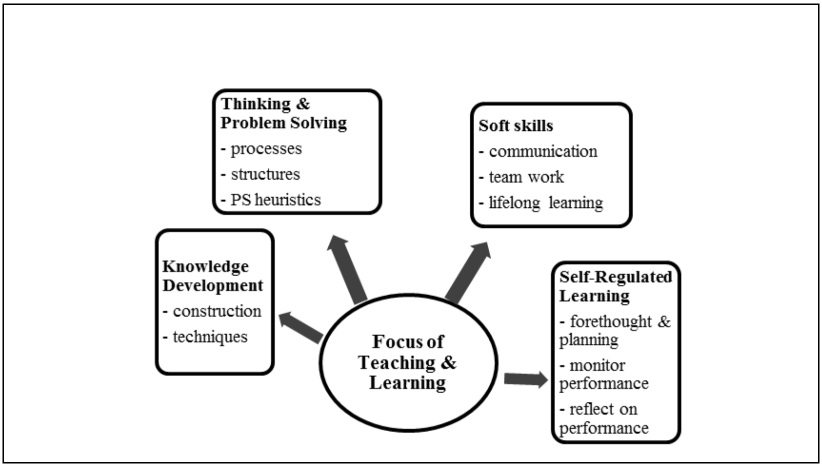

Figure 1: Focus of Teaching and Learning

ii. **Structured Examples**: Examples are structured in a manner that would lead towards a generality. Students worked on typical examples first, then on generic examples leading towards more general examples. To further strengthen their understanding and knowledge, non-typical examples were also given and they were asked to make up their own examples. We used students' own examples to assess what they attended to in the topics taught and helped in uncovering what they did not understand.

iii. **Students' use of their own thinking powers**: the tasks also encouraged students' use of their own thinking powers. Opportunities for students to explore linkages and connections between mathematical ideas were provided. The tasks allowed students to experience the mathematical thinking activities as well as opportunities of expressing mathematical ideas and objects in words, pictures, and symbols as well as in written and verbal form. Thus, we also emphasised communication of mathematical concepts and ideas.

iv. **Using mathematical themes; prompts and questions**: We used mathematical themes such as '*invariance amidst change*', which form the basis for many mathematical theorems and technique; '*doing and undoing*', which can help students identify features or structures that should be the focus of attention. The '*prompts and questions*' that we used were specially constructed to make explicit the internal structures of mathematics and mathematical thinking, focused students' attention to the structures and processes of mathematical thinking, provoked and invoked students' awareness of their own mathematical thinking powers, and provided students with simple vocabulary to generate mathematical discussion. We started by supporting students in *specializing* and *generalizing*.

v. **Using a workbook:** Our structured examples, prompts and questions, mathematics tasks and activities were created such that they would introduce students to mathematical ideas, thinking activities as well as provided questions to promote discussions. To ensure students had a compilation of these tasks, we designed a workbook that had five distinctive features to help students to become more familiar with our way of teaching, namely *Illustrations*, *Structured Examples*, *Making Sense*, *Reflections*, *Review Exercises* and *Further Exercises*.

2) SRL processes

The course is delivered to encourage independent learning. Students have to work on the topics by reading the text or notes on their own, discuss the concepts and examples as well as work on the exercises in their groups. Lecturers will monitor the class progress, acts as facilitators and will attend to the students in their groups. However, some examples are explained to students in a lecture setting and if any topic is found difficult by the students, a lecture may be delivered. The teaching sessions are of two hours duration meeting twice a week. To support and encourage students to adopt SRL processes, the following strategies were used.

i. **Forethought and planning:** students are given the *Course Outline* at the beginning of the semester that contains information about the course outcomes, weekly schedule, students' Learning Time calculation and the assessment information, namely, types, dates and marks allocated. In addition, they are also provided *Learning Guides* which gives them information on topics outcomes, amount of time for each topic and sub-topic coverage and the assignment questions. They are encouraged to manage their own learning by using these guides.

ii. **Performance monitoring:** questions to help students monitor their knowledge and mathematical skills development is given in a section named, *Making Sense*. The questions in this section is focused on students' understanding of the concepts taught and their awareness of their facility with the mathematical procedures and techniques. Students are to answer these questions which will be submitted to be reviewed by the lecturer. They are also encouraged to review their learning to make sure that they have achieved their topics outcomes. On the lecturer's part, she will review students' responses and comapre to their performance in the assessment tasks. If a particular question in the assignment is wrongly or poorly answered by a number of students, the misundertanding or mistakes are then addressed by the lecturer in class.

iii. **Reflections monitoring:** we have identified a section, named *Reflections* in the book with extra questions handed to students in the *Learning Guides*. These questions addresses the students' ability to manage their study, their time, their emotional response to the study of a particular topic or in general, effective learning strategies, learning difficulties, strategies to overcome those difficulties and their levels of motivation. They have to evaluate their stregths, weaknesses, things they like about the course, teaching and learning as well as suggestions of things they would like to change. These self-reflections should influence students' future planning and goals, initiating the cycle to begin again. These reponses are collected so that the lecturer can also monitor students' concerns and address them accordingly in the next class.

3) Soft skills development

i. **Teamwork:** Collaborative and active learning strategies were used to support students' participation, encourage discussion, and teamworking skills. To ensure that they have stamina and encouragement to persevere using the SRL methods, students worked collaboratively from the beginning which meant that the whole class atmosphere was active where students can discuss and helped each other to learn. The lecturers function as facilitators are readily available to be consulted. Teacher monitoring and providing specific feedback helped students in their knowledge and skills development. Students have to go through the book by themselves and in their groups as well as work on their assignments and mini project together. We created a conducive environment with student-centered teaching to promote students participation and engagement with the mathematics as well as opportunities for communicating their mathematical knowledge. The important elements that supported effective active learning; talking, listening, reading, writing and reflecting (Meyers & Jones, 1993) were elements that we actively incorporated in our class activities and tasks.

ii. **Communication:** since the students mainly work in their groups, much discussion is carried out. Sometimes, a students is called upon to share with the class their understanding of concepts taught and examples of problems that they have solved. In terms of other forms of communication, the sections on *Making Sense* and *Reflections*, address emotional, cognitive and performance monitoring skills which are then shared in written form.

CONSTRUCTIVE ALIGNMENT

We used Biggs and Tang (1999, 2010; see Figure 2) theory on constructive alignment and has planned that the teaching and learning activities and assessment tasks should help achieve the course outcomes. The course outcomes addresses four main areas, knowledge and skills, problem solving, teamwork and lifelong learning. They are mapped to the programme outcomes and are compliant with the Malaysian Quality Framework requirements. Communication is not an explicit course outcome but we have decided to include it as we know from experience that students have to be supported to communicate their technical knowledge, their views and feelings about the course and the learning process in general. We felt that some students may have used SRL processes, there will be others who have to be made aware of these processes.

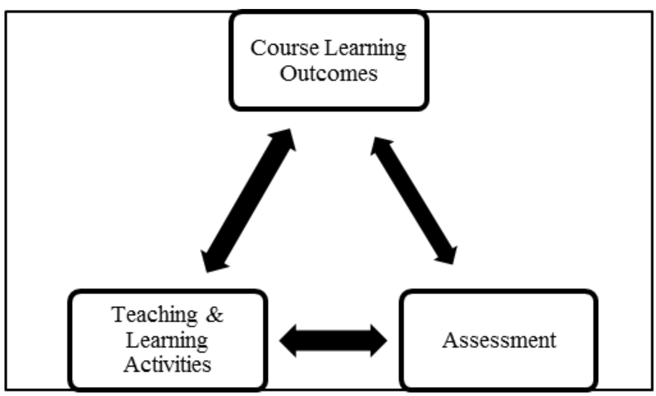

Figure 2: Constructive Alignment

From the brief description given earlier about how tasks are created, for example, we have tasks that will make students use their thinking powers, using prompts and questions to make them aware of their use of those powers. Thus, an assessment task will be questions where the same powers have to be used and demonstrated in the answers. Another example, is the use of a mini project where students have to solve problems that are non-routine so that they can exercise their problem solving skills. The teaching and learning tasks are carried out in small groups so the students are always actively occupied in their learning and have to rely on their team members for successful learning. We also use constructive alignment to monitor students' performance and achievement of the outcomes.

THE STUDY

We used these modified teaching strategies in two classes of students taking the Engineering Mathematics 3 (Multivariable and Vector Calculus) in Semester 1, academic session 2012/2013. The total number of students was 65 made up of 33 students from the second year Electrical Engineering (SMJE) and 32 students from the Mechanical Engineering (SMJM) Programmes. This will be the first course where the students will be asked to work and read through the chapters by themselves, individually and in their groups. A workbook and text book was used in the course. The workbook was written by the authors and incorporated several features to support development of mathematical thinking and independent learning (Yudariah et al, 2009). The courses in UTM followed the semester system and ran for 14 weeks. In this course, we had to cover 5 main chapters, Multivariable Functions, Partial Differentiation, Multiple Integrals, Vector Calculus, Line and Surface Integrals. The teaching and learning tasks were based on various examples and questions set out in the workbook. We did from time to time, used additional examples for classroom work. Some lectures were given, especially at the end of a chapter, when a Review session was conducted to ensure that students had grasped the mathematical concepts and techniques they have learned. The assessment tasks that contributed to their grades were chapter assignments, tests, a mini project and the final examination. However, several non-graded tasks were also given in the class when students were asked to share with their peers about problems that they were working on or to teach their colleagues some of the concepts learned.

We used the action research methodology to study the impact of teaching the classes with these strategies as it had several features that were appropriate in our situation. Firstly, action research is a systematic examination of personal practice with a commitment to educational improvement (Mcniff, Lomax & Whitehead, 1996). It is also a more user-friendly and practical approach to conducting research with one main purpose which is to improve teaching and learning (Slavin, 2006). The research was carried out in cyclic phases of "Planning of Teaching, Learning and Assessment (TLA) Activities and Tasks; Implementation; Analysis and Reflecting on the implementation results; Review and modifications of the TLA, if necessary (please refer to Figure 3).

Data was collected, analysed and contributed towards further planning of the TLA. However, as an effort to systematically review the effectiveness of the teaching and learning methods and adoption of SRL, we collected data through various methods such as, (a) observations of students, (b) students' work, (c) students' **reflections** on their learning and finally, (d) students' answers on how they **make sense** of the mathematical knowledge learnt, and finally (e) performance in examinations.

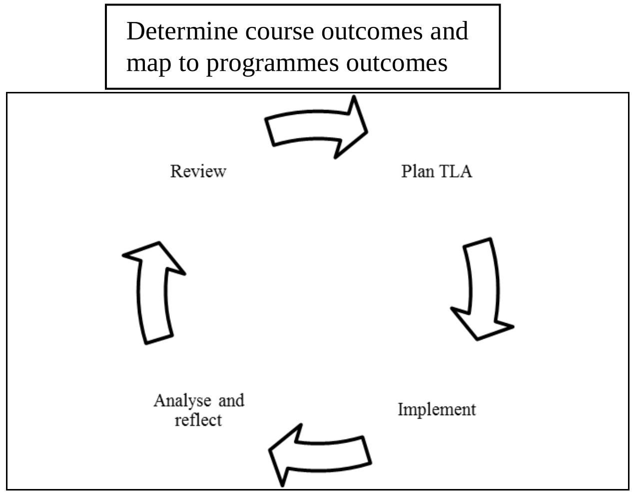

Figure 3: Model of research activities

Data was interpreted as they were collected and helped us adapt or modify TLA and informed our responses to students' concerns or behavior. Students' responses in *Making Sense* and *Reflections* questionnaires helped us in making comparisons between what was observed during class sessions with students' more considered responses in the questionnaires and performance in the assignments and tests. However, we reviewed the whole process regularly, consider the various phases of the cycle; the TLAs implemented, conclusions made based on examination of data collected within the teaching period, and identified factors and issues that have to be considered before the next class. We incorporated the deliberation of the data collected from the study within our regular sessions of coordinating the teaching and learning which was undertaken after the conclusion of each chapter.

RESULTS AND DISCUSSION

At the end of the course, we have prepared the Course Review Report (CRR) which reports the students' overall performance in the assessment tasks and the final examination and their attainment of the course outcomes and programme outcomes. All the students passed the course with the following results.

Grades	A+	A	A-	B+	B	B-	C+	C	C-	D+
%	6.11	10.75	4.55	12.36	21.55	19.89	12.36	9.33	1.57	1.57
Total	21.41%			53.8%			23.26%			

Table 1: Students' final results

The grades were distributed in all the categories, although this performance was slightly better than their performance in Engineering Mathematics 2. A closer analysis at the achievement of the Key Performance Index (KPI) of the course outcomes will give a better picture of their achievement. The Faculty has set the KPI at 0.65 which corresponds to a B grade. Generally, SMJE students had good achievements for all the course outcomes except for the topic of Multiple Integration (0.63). In contrast, SMJM students had slightly lower achievements in Multiple Integration (0.53) as well as Vector Calculus (0.63). However, the performance of both groups of students for the project was exceptionally good (0.9) but does not match their achievements in knowledge (0.80) and mathematical skills (0.85). This indicates that there is a need to review the problem solving questions and the marking scheme of the problem.

Here, we will share some of the students' responses in terms of the teaching and learning sessions carried out. Some of the responses were very positive in terms of the delivery method, "*Very interesting and fun course.*", "*Challenging and interesting*" and "*Make me think more and make me always revise before doing any questions*". However, we had students who were not too happy and wanted "*More question with answer scheme. More stress with example of question for final exam*", and "*Make this course less sentence but has more number and no complicated graph and include all the formula in exam paper*". We had more positive responses from the students than the less enthusiastic ones. However, we did respond to the students' concerns about their ability to answer the final examination questions by conducting revision sessions and practice in answering past year questions. We understood that the students'were very concerned about performing well in examinations.

Responses from students' Reflections gave some indications that they were aware of SRL processes in terms of Performance and Reflections Monitoring, as students worked through the course although much of the responses were more in the nature of 'what needs to change'. For example, a student wrote that what he would like to change was "*My laziness. My time management*" while another say that she should pay more attention to "*Time management. My attitude*". When asked, 'what would they do differently when working through a topic', some responses indicated that that they would '*read more*', '*do more exercises*', '*group discussion*' and '*search the internet*'.

A simple criteria was used to categorise the "Making Sense' responses, which is, "ability to display correct mathematics, clear explanations and the correct use of symbols and notations. A rubric in a range of 1 to 4 was used with 4 referring to '*Very Good*' and 1 referring to '*Poor*'. Most of the students' responses were in the range of 3 and 4, although there were responses in 1 and 2. We used the responses to identify students who had difficulties with the mathematical concepts and techniques as well as which concepts and techniques were found difficult by students. These were then addressed in class by the lecturer and any misconception or application of the techniques was highlighted in lectures and examples. Students were also using their responses to articulate their difficulties in the course.

In answering questions about teamworking, most of the responses were very favourable. Amongst these: "*Helps us to cooperate amongst ourselves. Widens our view"; "Help ourselves understand better. Yes, member is supportive and helping each other."; Very good and helpful. Encourage me to work harder. Very supportive and helpful."* The way of working was not familiar for the students, that is, to study a whole course on their own but in groups. However, they became very adept at managing their own work. Our observations saw that they would get down to work in their groups as they come to class. In the beginning, they needed some reminders to review the amount of time that they are spending on a topic and to check against the Learning Guides. Usually, we had to monitor how much time were spent on particular topics to ensure that they had time to work through other topics. As the semester progresses they were more able to manage their time and we saw that they were using the Learning Guides to pace their work and also to remind us of any assessment tasks that had been scheduled.

Although these findings are very preliminary, we think that they indicated some awareness of the SRL processes have occurred as well as adoption of cooperative learning habits. A particular joy for us was that our students were quite happy in holding discussions, reaching out to us for help, much more willing to share their concerns and generally much more communicative about their mathematics, their learning needs or difficulties. The classes are active and dynamic, in their own words,"*You did a great job teaching us*"; "*Class not boring. Lecturer understanding the students*".

CONCLUSION

We set out to support and develop students' awareness of their own thinking powers as well as SRL skills as we felt that these are the skills that will help them become flexible and independent learners, able to take charge of their own learning. Various strategies were used, incorporating new ones on SRL to our tried and tested strategies for enhancing mathematical thinking. Although the results are considered at a preliminary stage as we have just finished teaching two groups of students in one session, we felt that there are indications that students will make effort to adopt much more efficient learning behaviour if they are supported through the constructive alignment of the teaching and learning activities as well as assessment tasks.

ACKNOWLEDGEMENT

We would like to extend our gratitude to MJIIT for allowing us to carry out these TLAs.

REFERENCES

Anthony. G. (2000). Factors influencing first year students' success in mathematics. *Int Jnl of Math Edn in Sc & Tech*, Vol. 31 (1), 3-14.

Biggs, J. & Tang, C., (1999). Teaching for Quality Learning at University. Open University Press & McGraw-Hill Education, Berkshire.

Biggs, J. & Tang, C., (2010). Teaching for Quality Learning at University. 3rd Edn., Open University Press & McGraw-Hill Education, Berkshire.

Baharun, S., Mohd. Yusof, Y., & Abdul Rahman, R., (2008). Facilitating Thinking and Communication in Mathematics, DG 24, presented at ICME 11, Mexico.

Croft, A. & Ward, J. A, (2001). Modern and Interactive Approach to Learning Engineering Mathematics, *British Journal of Educational Technology*, Vol. 32, No. 2, pp 195 – 207.

de Bruin, A.B., Thiede, K.W., & Camp, G. (2001). Generating keywords improves metacomprehension and self-regulation in elementary and middle school children. Journal of Experimental Child Psychology, 109 (3), 294-310.

Engineering Accreditation Council Malaysia (EAC), (2012). Engineering Programme Accreditation Manual, Kuala Lumpur.

Harris, K. R., Friedlander, B.D., Saddler, B., Frizzelle, R. & Graham, S. (2005). Self-monitoring of attention versus self-monitoring of academic performance: Effects among students with ADHD in the general education classroom. *Journal of Special Education*, 39 (3), 145-156.

Hoch, M. & Dreyfuss, T., (2005). Students' Difficulties with Applying a Familiar Formula in an Unfamiliar Context, in Chick, H.L. & Vincent, J. L. (Eds), *Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education (PME)*, Melbourne, Vol. 3, pp145-152.

Mason, J., Burton, L. & Stacey, K., (1982). *Thinking Mathematically*. Addison-Wesley Publishing Company, Inc, Wokingham, England.

Mason, J., Burton, L. & Stacey, K., (2010). *Thinking Mathematically*. Addison-Wesley Publishing Company, Inc, Wokingham, England.

McNiff, J., Lomax, P. & Whitehead, J., (1996). *You and Your Action Research Project, Routledge & Hyde Publications*, London & New York.

Meyers, C., and Jones, T. B., (1993). *Promoting Active Learning: Strategies or the College Classroom*. San Francisco: Jossey-Bass Publishers.

Pintrich, P. R., & Zusho, A. (2002). The development of academic self-regulation: The role of cognitive and motivational factors. In A. Wigfield & J. Eccles (Eds.), Development of achievement motivation (pp.249–284). San Diego, CA: Academic Press.

Roselainy, Yudariah and Sabariah, (2007). Enhancing Thinking through Active Learning in Engineering Mathematics. *Proceedings of Fourth Regional Conference on Engineering Education*, Johor Bahru, 3 – Dec.

Roselainy Abdul Rahman, (2009). *Changing my Own and my Students Attitudes to Calculus Through Working on Mathematical Thinking*. Unpublished PhD thesis, Open University, UK

Roselainy, Yudariah and Sabariah, (2012a). *Realizing Desired Learning Outcomes in Undergraduate Mathematics*, In Khairiyah et al.(Eds), Outcome-Based Science, Technology, Engineering, and Mathematics Education. Innovative Practices, 182 - 206, IGI Global, Hershey, USA.

Roselainy, Yudariah and Sabariah, (2012b). Factors Affecting Students' Change of Learning Behaviour, *Procedia - Social and Behavioral Sciences* 56, 213 – 222.

Slavin, R. E. (2006). Educational psychology: Theory and practice, 8th ed. Boston: Allyn & Bacon.

Tall, D., (1995). Cognitive Growth in Elementary and Advanced Mathematical Thinking, Plenary Lecture, *Conf. of International Group of PME*, Recife, brazil, Vol. 1, p 161-175.

Tall, D. & Razali, M. R., (1993). Diagnosing Students' difficulties in Learning Mathematics, *Int Jnl of Math Edn in Sc & Tech*, Vol. 24, No. 2, 209-222.

Watson, A. & Mason, J., (1998). *Questions and Prompts for Mathematical Th*inking. ATM, Derby.

Wolters, C.A. (2011). Regulation of motivation: Contextual and social aspects. Teachers College Record, 113(2), 265-283.

Yudariah Mohd. Yusof, Sabariah Baharun & Roselainy A. Rahman, (2001). Mathematics Education in UTM: Learning from Experience, *Jurnal Teknologi*, Universiti Teknologi Malaysia, Johor.

Yudariah Mohd. Yusof, Sabariah Baharun & Roselainy A. Rahman, 2011. Multivariable Calculus for Independent Learners, Revised 2nd Edn., Pearson Malaysia Sdn Bhd., Kuala Lumpur.

Zimmerman, B. J. (2000). Attaining self-regulation: a social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation. San Diego: CA: Academic Press.