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METACOGNITION AND ITS RELATIONSHIP WITH STUDENTS' ACADEMIC PERFORMANCE

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Abstract
This paper discusses metacognition, defined as thinking about one's own thinking, and its relationship to student's academic performance. A number of previous studies have shown that metacognition and intelligence were associated, and therefore suggested that students who have metacognition tend to be successful learners. This paper also reports on a study investigating the relationship between students' academic achievement and metacognitive awareness, which has been done a private secondary school in Patiala . An established instrument by Shraw and Anderson's Metacognitive Awareness Inventory is used for the purpose of this study. Specifically, this study examined the relationship between student's academic performance and each of the five components of metacognition regulation namely planning, information management strategies, comprehension monitoring, debugging strategies and evaluation. It also examined metacognition awareness in students across gender and different academic years. Overall, the findings revealed a significant positive relationship between student's academic performance and metacognitive awareness, a significant difference in metacognition awareness between Form 2 and Form 5 students, and no significant difference in metacognition awareness between male and female across all academic years. Some suggestions to develop metacognition in students are discussed, and possible directions for research on metacognition in learning process are proposed. Keywords: Metacognition, metacognitive awareness, metacognitive knowledge, metacognitive regulation.

Introduction

Metacognition is simply and commonly defined as "thinking about thinking". Metacognition refers to the knowledge that people have about their own thought processes The term "metacognition" has been used in psychology and education research literature since mid 1970s. It is most often associated with John Flavell, who first used the term formally in the title of his paper in 1976. He defined metacognition as follows: "In any kind of cognitive transaction with the human or non-human environment, a variety of information processing activities may go on. Metacognition refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in service of some concrete goal or objective. In essence, metacognition is the knowledge and the active monitoring of one's own cognitive processes. Indeed, we engage in metacognitive activities everyday. Another early contributor to the metacognition literature was Ann Brown (1978), who suggested knowledge of cognition (what we know about our cognition) and regulation of cognition (how we regulate or control our cognition to perform something) as the two primary principles of metacognition which are important for learning . Knowledge of cognition includes three components of knowledge namely declarative (knowing "about" things), procedural (knowing "how" to do things), and conditional (the "why" and "when" aspects of cognition). Regulation of cognition, on the other hand includes planning, regulation and evaluation. Knowledge of cognition helps people to selectively allocate their resources and use strategies more effectively, while regulation of cognition is linked to more systematic skills such as planning, monitoring, and evaluation. Metacognition refers to the ability to think about, understand and manage one's learning .Metacognition includes knowledge about learning and about oneself as a learner, and the skills of monitoring and regulating one's own cognitive processes. Schraw and Dennison (1994) defined regulation of cognition as comprising of the following five aspects namely planning, information management strategies, comprehension monitoring, debugging strategies and evaluation. Planning refers to goal setting and allocating resources prior to learning; information management strategies refers to the skills and strategy sequences used to process information more efficiently such as organiz-

ing, elaborating, summarizing and selective focusing; monitoring refers to the assessment of one's learning, comprehension and strategy used; debugging strategies refers to the strategies used to correct comprehension and performance errors; and evaluation refers to analysis of performance and strategy effectiveness after a learning episode. Highly meta-cognitive individuals excel in planning, managing information, monitoring, debugging, and evaluating. These abilities are no doubt essential for View metadata, citation and similar papers at core.ac.uk brought to you by CORE provided by Universiti Teknologi Malaysia Institutional Repository learning both individually and in cooperative groups. Learners who are aware of what they know, what they understand, what they do not know, what they do not understand, and why they do not understand for instance, are those who have metacognitive awareness. Metacognitive awareness allows learners to make self-reflection about his/her own cognition processes in such a way that enable them to observe, monitor, evaluate, and regulate their own thought processes that take place during learning. A number of previous studies have shown that metacognition, or the ability to control one's cognitive processes (Selfregulation), and intelligence were associated, and therefore suggested that students who have metacognition tend to be successful learners. According to Sterberg (1984, 1986a, 1986b), metacognition (self –regulation) which involves planning, evaluating and monitoring problem-solving activities are the executive processes of the brain. He refers to these executive processes as "metacomponents" in his triarchic theory of intelligence. Meta components are executive processes that control other cognitive components as well as receive feedback from these components. Furthermore, Sternberg claimed that meta components are responsible for "figuring out how to do a particular task or set of tasks, and then making sure that the task or set of tasks are done correctly" [23]. Sternberg concluded that the ability to appropriately allocate cognitive resources, such as deciding how and when a given task should be accomplished, is central to intelligence. Recent research has revealed the significance of metacognitive awareness in learning. For instance, learners who score high on measures of metacognition are more strategic more likely to use problem-solving heuristics better at predicting their test scores and generally outperform learners who score low on metacognitive measures. Metacognition has been shown to predict learning performance. Learners who are metacognitively aware know what to do when they don't know what to do; that is, they have strategies for finding out or figuring out what they need to do. More importantly, research has demonstrated the value of metacognition in predicting academic achievement. For example, greater metacognitive ability has been linked to grade point average math achievement and reading skill .In addition to this, studies explicitly show that metacognitive skills play an important role in effective learning that leads to academic success, and that academically achieving students are better on metacognitive measures [11, 25, 28] The present study aimed to investigate the relationship between metacognitive awareness and students' academic performance. Since learning is also implied at schools, academic performance is one way to assess a student's learning. In this study, students' academic performance will be measured based on the total average mark of their examination scores. Specifically, the research questions for the study were 1) What is the relationship between metacognitive awareness and students' academic performance? 2) What is the relationship between regulation of cognition and students' academic performance? 3) What is the relationship between knowledge about cognition and students' academic performance? 4) What is the relationship between knowledge about cognition and regulation of cognition? 5) Is there a difference in metacognition awareness between form 5 students and form 2 students? And 6) Is there a difference in overall metacognition awareness between males and females?

Methodology

Participants Forty form 5 students (20 female, 20 male) and thirty three form 2 students (18 female, 15 male) from Sunny Hill, a private school in Patiala participated voluntarily in this study. The age range for the participants from form 5 group was between 17 and 19 years (M = 18, SD = 3.1). The age range for the participants from form 2 group was between 14 and 16 years (M = 14.5, SD = 2.9). 2.2. Instrumentation An established instrument Metacognitive Awareness Questionnaire(-MAI), designed by Schraw & Dennison (1994) was used in the study. The MAI instrument consists of 52 statements to which participants respond by marking a Likert scale with numbers from 1 ("not at all true of me") to 5 ("very true of me"). The statements represent two component categories of metacognition, knowledge and regulation. Within the knowledge component were statements of declarative knowledge (knowledge about self and strategies), procedural knowledge (knowledge about strategy use), and conditional knowledge (when

and why to use strategies). The regulation component covered planning (goal setting), information management (organizing), monitoring (assessment of learning and strategy), debugging (strategies to correct errors) and evaluation (analysis of performance and strategy effectiveness). For the purpose of testing the reliability and face validity of the questionnaire, 30 students (15 form 2 students, and 15 form 5 students) from Sri Bintang Tuition Centre were administered the inventory. Items were first reviewed for face validity. The items appeared to be easily understood, therefore none of the wordings and grammatical structures were changed or improved. The inventory was then tested for its reliability. The reliability analysis indicated high internal consistency for the entire scales; Knowledge of Cognition: .79; Regulation of Cognition: .84. The alpha coefficient was found to be .89 for overall inventory. The inventory, after undergoing these processes, ended up remain the same as the original version by Schraw & Dennison (1994). 2.3 Procedures. A short meeting was held with the principal representative of the school before the implementation. The aim of the study and the application procedure were discussed. The MAI test was given to students during their regularly scheduled class hours and the instrument was administered by classroom teachers. It took approximately 10 minutes for students to finish answering all the questions. 2.4 Data Analysis Frameowork After the questionnaire is completed the score on each item is summed together, to create a test score for the participant of type interval data. Since scores resulting from the study is interval data, so parametric statistical tests were used. For each group (Form 2 students, Form 5 students, and the pooled group of all participants) descriptive statistics were generated. These included the means, standard deviations, minimums, and maximums for variables of MAI scores and total average of examination scores. Secondly, Pearson Corr. was used to detect correlation between average examination scores and each of the three MAI scores (knowledge, regulation, and total). Thirdly, the independent t- test was used to detect differences in metacognitive knowledge, metacognitive regulation, and total score between the Form 2 students and the Form 5 students. Finally, independent t- test was used to compare the MAI scores for males and females for each group.

Results

Descriptive Statistics for Sample Groups. Table 1, Table 2 and Table 3 present the descriptive statistics for the participants in the research study. Results for the research questions will follow. Table 1. Descriptive Statistics for Form 2 Sample Group Variable Mean Std Deviation Minimum Maximum Form 2 Students (N= 33) Total average of examination scores 75.4 8.0 55.9 89.5 MAI knowledge score 71.3 8.2 55 79 Mai Regulation score 119.2 15.3 77 159 MAI total score 185.5 20.2 131 241 Table 2. Descriptive Statistics for Form 5 Sample Group Variable Mean Std Deviation Minimum Maximum Form 5 Students (N= 40) Total average of examination scores 66.6 7.6 53.8 82.7 MAI knowledge score 76.6 6.2 61 82 Mai Regulation score 133.2 18.2 84 167 MAI total score 199.3 18.9 149 253 Table 3. Descriptive Statistics for Pooled Sample Group (Form 2 and Form 5) Variable Mean Std Deviation Minimum Maximum Pooled Form 2 and Form 5 Students (N= 73) Total average mark of examination scores 71 9.9 53.8 89.5 MAI knowledge score 74.1 7.7 55 82 Mai Regulation score 127.1 17.1 77 167 MAI total score 188.4 21.5 131 253 Correlation of Students' Total Average Mark of Examination Scores with MAI Scores Table 4. Correlation between Students' Total Average Mark of Examination Scores and MAI Scores Metacognition Knowledge Metacognition Regulation, MAI Total score Total average mark of examination scores N r p R P R p Form 2 33 .23 .175 .54* .042 .68** .000 Form 5 40 .31 .161 .70** .000 .71** .000 All Participants 73 .65* .039 .72* .032 .77* .039 In both groups, the pattern of results was similar. Significant correlations of Total average of examination scores with metacognitive regulation scores and MAI total scores were found in both Form 2 and Form 5 groups, but not with metacognition knowledge. Students' academic performance (measured by the total average of examination scores) appeared to be highly related to the MAI scores for the Form 2 group ($r=0.68$, $p< .001$) and for the Form 5 group ($r=0.71$, $p< .001$). Students' academic performance was also positively related to the metacognitive regulation for the Form 2 group ($r=0.42$, $p < .05$) and for the Form 5 group ($r=0.70$, $p< .001$). For the pooled group of 73 students, Students' academic performance was correlated with each metacognitive knowledge ($r=0.65$, $p < .05$) , metacognitive regulation ($r=0.72$, $p < .05$), and total MAI score ($r=0.77$, $p < .05$). (See Table 4) Correlation of MAI Knowledge Scores with MAI Regulations Scores Table 5. Correlation between Metacognitive Knowledge and Metacognitive Regulation MAI Knowledge Scores R P MAI Regulation Scores .13 .210 The correlation between metacognitive knowledge and metacognitive regulation was non-significant

(r=0.13, p= 0.210). (See Table 5). Comparison of MAI Scores between Form 2 Students and Form 5 Students The independent t- test was used to detect any significant differences between Form 2 students and Form 5 students in their MAI knowledge scores, MAI regulation scores and MAI total score. A significant different was found between the Form 2 and the Form 5 students in metacognitive knowledge ($t(71)= 1.021$, $p < .05$) , metacognitive regulation ($t(71)= 1.621$, $p < .05$), and MAI total scores ($t(71)= 2.653$, $p < .05$). Overall in all three set of scores, there were significant differences between the Form 2 students and the Form 5 students who participated in the study. (Results are summarized in Table 6, Table 7 and Table 8). Table 6. Comparison for MAI Knowledge Scores between Form 2 Students and Form 5 Students MAI Knowledge Scores T P Form 2-Form 5 Students 1.021 . 042* Table 7. Comparison for MAI Regulation Sores between Form 2 Sudents and Form 5 Sudents MAI Regulation Scores T P Form 2-Form 5 Students 1.621 .039* Table 8. Comparison for MAI Total scores between Form 2 students and Form 5 students MAI Total Scores T p Form 2-Form 5 Students 2.653 .021* Comparison of MAI total scores between Males and Females The independent t-test was used to detect any significant differences between male and female students in MAI total score. No significant gender differences were detected among the Form 2 students ($t(31)= 1.151$, $p< 0.05$) ** Significant result ($p < 0.01$) 4.0 Discussion The present study focused on examining the relationship of metacognition with students' academic performance. Additionally it compared metacognitive awareness in students across academic years and gender. Results indicate that a positive relationship between metacognition and students' academic performance exists in the sample researched. It seems that students who do well in examination are better on metacognition measures. Metacognition is no doubt important in one's learning process. Student who has metacognition awareness understand himself as a learner, know the best learning strategies that work for him, and know when and why to use such strategies. More importantly, metacognitive students are very good at planning their learning, monitoring their progress and learning strategies and evaluating their learning strategies, learning output, self-strengths and self-weaknesses through out the whole learning process. Metacognitive student has the ability to think about, understand and manage his own learning . Previous studies shows that learners who score high on measures of metacognition are more strategic and generally outperform learners who score low on metacognitive measures Students who have metacognition also tend to be successful learners. Interestingly, the results observed from individual group of Form 2 and Form 5 students show that students' academic performance seems to correlate positively with metacognitive regulation, but not with metacognitive knowledge. Furthermore, no significant relationship was found between metacognitive knowledge and metacognitive regulation. Perhaps metacognitive regulation, the knowledge about one's learning strategies rather than metacognitive knowledge is more dominant in students as a significant factor in academic success. As emphasized in the MAI, regulation of cognition comprising the following five aspects namely planning, information management strategies, comprehension monitoring, debugging strategies and evaluation. Students who are highly metacognitive self-regulated are those excel in planning, managing information, monitoring, debugging, and evaluating Many studies show that students who use metacognitive strategies are more successful compared to the ones who do not, and teachers can play important role to develop these strategies in the students On the attempt to seek any differences in metacognition awareness between Form 2 and Form 5 students, the results show significant differences between the Form 2 and Form 5 students in metacognitive knowledge, metacognitive regulation and overall metacognitive awareness. Demographic statistics tables for both groups shows that the means for each MAI knowledge score, MAI regulation score and MAI total score for Form 5 group are higher than the Form 2 group. It can be concluded that the Form 5 students are significantly better on their metacognitive awareness. Though, the total average of examination scores of the Form 2 group is higher (75.4) than Form 5 students (66.6), this does not provide concrete evidence to say that metacognition is not important in determining one's academic performance. Possible factors for instance the different levels of difficulty in the courses taken at different academic year, perhaps could lead to the slightly lower total average marks for the Form 5 students as compared to the Form 2 students. These results also suggest that metacognitive awareness tends to increase with academic years. The form 5 students tend to have higher scores for metacognitive knowledge, metacognitive regulation, and also in overall metacognitive awareness than the Form 2 students. Perhaps age be the factor here, because generally students experiences and maturity are increase in line with their ages. They could have become more aware about their

self-responsibility in their own learning process, and therefore become more self-regulative- that is better at planning the best strategies for learning, better at monitoring their progress in learning and most importantly become aware of the importance of evaluating what how they have been doing so far, how should they improve, and why they should improve to be not only to be a highly academic achiever but perhaps most important, useful and meaningful is for them to become a better metacognitive learner. The results are collateral with the finding of research study by Rasnak (1995), who found that the concepts of learning process, the level of metacognitive knowledge and the use of learning strategies (metacognitive regulation) were significantly better changed and improved as the age increases As for the last research question about the differences between females and males in overall metacognition awareness, the results shows no significant gender differences among the Form 2 students, the Form 5 students, or the pooled group. Not much is known about any previous literature that showed clear evidence on gender difference in metacognition. Perhaps more studies need to be done to research on this issue. In sums, findings of the present study provide significant information about the concept of metacognition in learning and the its relationship with students' academic performance. Overall results showed metacognition and students' academic performance were correlated, and metacognitive regulation rather than metacognitve knowledge was found to be highly related to students' academic performance. Significant differences were observed in metacognition awareness between the Form 2 students and Form 5 students, but yet on gender differences, the results showed no clear advantage of any particular gender over the other ones. Meta cognition is very important in one's learning. The use of meta cognitive strategies ignites one's thinking and can lead to more profound learning and improved performance, especially among learners who are struggling.(Swanson, 1990). These meta cognitive strategies can be developed in oneself. Students who are aware of their own cognitions or thoughts processes, will be more responsible of their own learning processes. These are some practices or meta cognitive activities students should do to develop their meta cognition: 1) talking about thinking, 2) keeping a thinking log, 3) identifying "what you know" and "what you don't know", 4) Planning and self-regulation and 5) self-evaluation. Talking about thinking is similar like thinking aloud, in which students verbalize and internalize their thoughts to themselves. This technique is best practiced in small groups, where students can take turn asking questions, clarifying and summarizing the topics being studied. When one student talks through a topic, he actually describing his thinking processes to himself and to his peers. Developing meta cognition through a thinking log involves students making self reflection upon their own thinking or thoughts and its progress. Teachers can very much help on this by asking students to write a reflection on what they have learnt , the things they understood and the things they do not understand on the day itself. The third practice is students should identify what they know and what they do not know at the beginning of any new topics learnt and this can be done via self-asking approach at the beginning of any classes. The purpose is so that the students can make conscious decision about their role as a learner, in particular for the purpose of that specific topic/course and as well as, about their existing knowledge on the topic/course they are currently undergoing – things such as what they already know , and what they want to learn about from that class. This session is important because it acts as the first step to develop meta cognition skills in our students. The fourth and the fifth practices basically complement each others. Planning, self regulation (monitoring) and self-evaluation as mentioned earlier in the literatures are very important to ensure successful learning. Finally, taking into considerations of some limitations in the present study, the possible directions for research on meta cognition are proposed. The sample size used for this study to examine the generated research questions was rather small and composed of only the Form 2 and Form 5 students. This may be a limitation of the generalizability of the study findings. In future studies, to put our current understanding of metacognition in students in broader perspective, a larger picture is needed. Therefore the metacognitive inventory should be applied to more different academic years and age groups. This may involves assessing the relationship of metacognition with students' academic performance at various levels of education stages, at pre-school, primary school and secondary school for instance. To do this definitely, the suitables metacognitive inventory need to developed to suit each researched group. Perhaps with a more holistic and bigger sample size, significantly concrete results can answered the research questions of the present study. Another limitation is, in the present study, the only criteria of the academic performance was their total average mark of examination scores. These marks may not be a valid indicator of true performance or

achievement. In addition to the total average marks of the examination scores, different criteria for the identification of academic performance should be used. Rather than relying on one criteria of performance or achievement, various sources of information would be more valid indicators to academic success and this need to be further identified and researched. 5.0 Conclusion Metacognition enables one to be successful learner, Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Because metacognition plays a critical role in successful learning, it is important to develop metacognition in students, and to do this teachers, parents and the students themselves should play their respective roles to develop the metacognitive environment, be it in school or at home, by encouraging more metacognitive activities of which some have been mentioned above.

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