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METACOGNITION ABOUT READING IN SINGAPOREAN CHILDREN: ISSUES IN MEASUREMENT

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Abstract: How well children plan and monitor their own reading relies on what they know about the goals, tasks, and strategies of reading. If it is believed that metacognition is to be useful for readers, teachers and researchers, more attention needs to be paid not just to the definition of metacognition but also to the creation of appropriate measures of metacognition. Little agreement has been reached about the most effective ways of measuring metacognition. In a pilot study with Singaporean English Dominant and English Non-Dominant students, an examination of the types of metacognitive strategies applied and the frequency by which the strategies are applied is carried out. In a previous study, a 21-item trial inventory was administered to 11, 13 and 15 year olds. The findings highlighted the need to further improve and fine-tune the items for measure. The developments on this instrument and the findings made will be discussed.

Introduction

This is a pilot study which aims to discover the application of metacognitive strategies by Singaporean students during the reading of the English language. It attempts to measure metacognition through two metacognitive inventories, which are to be validated, drawing on previously applied instruments (Jacobs & Paris, 1987; McLain, Gridley & McIntosh, 1991; Miholic,1994; Schraw & Dennison, 1994). Not only are we concerned about the strategies applied by local Singaporean students, we are also concerned about the frequency by which these strategies are applied.

The definition of metacognition bears implications on the design of the instrument used to measure metacognition, thus this must be addressed first. Metacognition has been described as “cognition about cognition”. A distinction has been made between knowledge about cognition and the regulation of cognition (Flavell, 1987). Jacobs and Paris (1987) divided metacognition into two broad categories. Self-appraisal of cognition was referred to as the static assessment of what an individual knows about a given domain or task. This included three subcategories of thinking, the declarative, procedural and conditional knowledge. Self-management, on the other hand, was referred to the dynamic aspects of translating knowledge into action, which involves planning, evaluation and regulation. Recently, the term self-regulated comprehension which connotes monitoring and control of reading processes, was proposed by Hacker (1998). This model suggests that goals for reading are laid down prior to or during reading. When such goals are not met, readers evaluate the monitored failure at all levels of text representation. This would involve the selection of the standards of evaluation that are specific to the levels which are being evaluated. To enhance comprehension, monitoring and control strategies are applied to facilitate information processing.

The literature has demonstrated clear differences between the metacognitive strategies adopted by good and poor readers. Skilled readers are adept at a number of reading strategies (Schraw & Dennison, 1994) while poor readers are not as good at knowing or applying metacognitive strategies to aid reading comprehension (Garner, 1987; Palincsar & Ransom, 1988). The literature has also suggested that younger readers are less likely to notice major blocks to text understanding (Wray, 1994).

Different explanations have been offered for failures to comprehend written discourse, with respect to failures to monitor or control comprehension (Hacker, 1998). This may be the result of a variety of techniques being used to study cognitive monitoring in reading. For e.g., interviewing and examining self-corrections. These have been subjected to problems of interpretation such as fallible memory or inadequate verbal abilities. Certain procedures are also prohibitive in most applied settings due to the amount of time and effort required to administer them (Shraw & Dennison, 1994).

A previous study conducted in 1999 demonstrated the need for a revision of the instrument used to measure the types of metacognitive strategies applied. This led to the development of two metacognitive awareness inventories, bearing in mind the problems associated with the previous inventory. The inventory measuring the types of strategies applied was improved considering concerns like the rewording of questions and response options to overcome ambiguity; the addition of options to items where appropriate; re-categorization of response options to enable a more objective and accurate scoring of the options; and the addition of items measuring conditional knowledge, that is, when and why strategies are used, in line with the definition of metacognition. Due to the eventual aim of the research to design an intervention programme, it was decided that examining the frequency by which the students apply the metacognitive strategies during the reading process would be helpful. This led to the development of a second inventory.

The present study thus attempts to discover the extent to which metacognitive strategies, which include monitoring, planning, evaluation and the use of conditional knowledge, are applied by students of different language backgrounds, namely the English Dominant (ED) and the English Non-Dominant (END) students, during the reading of English language texts. The types of metacognitive strategies used, as well as the frequency of usage, will be examined.

Singapore is known to be multi-racial and multilingual, thus some attention should be given to this. The government has adopted a strategy of equal treatment for English, Chinese (Mandarin), Malay and Tamil, all of which are taught in schools (Gopinathan, 1998). School bilingualism has been implemented and emphasis has been placed on the instruction of two languages, with the bilingual policy being of central importance. While some Singaporeans consider English as the preferred language, majority still come from homes where Chinese, Malay or Tamil is spoken more frequently than English (Sim & Lee, 1992). This unusual language situation of Singaporeans explains why the selected sample is of concern in the present study.

Bearing the above findings and limitations in mind, it is predicted that the ED students, who speak the English language more frequently and are skilled readers (Wong & Underwood, 1996), would demonstrate greater application of the appropriate metacognitive strategies. These students will also apply the strategies more frequently. On the other hand, the END students who speak the English language less frequently and are less proficient in the language, are expected to apply the less appropriate metacognitive strategies while reading and also to apply the strategies less frequently. In addition, it was expected that the older the student, the more adept they would be in their application of metacognitive strategies when reading.

Method

Participants

The following table presents the distribution of participants.

Table 1: Distribution of subjects according to educational level and stream

		English Dominant (ED)	*English Non-Dominant (END)*
Primary 5 (P5)	*EM1*	20	3
	EM2	15	7
Secondary1 (S1)	*SAP*	6	17
	Express	14	4
	Normal academic	6	6
Secondary3 (S3)	*SAP*	8	11
	Express	14	6
	Normal Academic	2	14

One hundred and fifty three participants consisting 90 boys and 63 girls from four schools of varying academic standards in Singapore participated in the study. All participants were Chinese by origin for practical reasons of access as they account for the majority of the student population. Primary 5 (P5) students were selected from two primary schools. Students at this level were considered suitable as they had been found to be cooperative and responsive (Wong & Underwood, 1996). Sampling of the participants also benefited from the national streaming examination at primary four. As EM3 students have poor proficiency of the English language, they were not included in the study.

Secondary one (S1) and secondary three (S3) students were selected from two secondary schools. The S1 students were selected on the basis of the national examination called the Primary School Leaving Examination (PSLE). The selection of S3 students was based on the performance of the students in the mid-year school examination at S3 level. As far as possible the students' performance in both the English language and their mother-tongue, Mandarin Chinese, were matched, e.g., a student with a grade A in English would have a grade A in Mandarin, as far as possible. This served to control the balance in their abilities for the respective languages mentioned. Participants were placed into the language groups of ED or END which are discussed below.

Instruments

Questionnaires Determining Language Dominance

Two questionnaires each consisting of 37 items included four "dummy" items to help the students to familiarize with the process of completing the questionnaire. The first questionnaire aimed to discover the frequency at which English language was spoken by the students when communicating with their parents, teachers, siblings and friends. The second aimed to discover the frequency of Mandarin Chinese spoken. Both questionnaires composed of the same questions but these were presented in randomized order in the second questionnaire.

The responses were scored on a 5-point Likert scale (Always=4, Often=3, Sometimes=2, Seldom=1, Never=0). Due to the small sample, the stringent measure of 65-70% and more as a cut-off point taken for students to be classified as ED, and 30-35% and below to be classified as END were readjusted. In this study, scores of 60% and above on the English Dominant (ED) questionnaire were considered ED, and 40% and below on the Chinese Dominant (CD) questionnaire were considered END. As the sample was too limited, 55% and more on the ED questionnaire and scores of below 45% on the CD questionnaire were also acceptable. It should be emphasized that the term dominance is used here with respect to the frequency of usage and not proficiency.

Reading Proficiency Test

The selected ED and END subjects performed in the Stanford Diagnostic Reading Test (SDRT) (Karlsen & Gardner, 1995). This served to verify that ED students are more proficient than the END students in reading and vocabulary. The SDRT measures decoding, comprehension, vocabulary and scanning, within which are subcategories that reflect the developmental characteristics of the reading process in depth and breadth. Three (purple, brown and blue levels) of the six levels of diagnostic evaluation were utilized in the present study, for the respective age-groups of students. The purple level was administered to the P5 students, brown to the S1 students and blue to the S3 students.

Metacognitive Awareness Inventories

Two inventories were designed. The first aimed to discover the students' awareness and application of strategies and the second aimed to discover the frequency of application of strategies. The inventories included brief cover instructions informing individuals that the purpose of the respective instruments was to discover the types of strategies and frequency of application of the metacognitive strategies.

Inventory I (MI): This was an inventory of 35 items with four or five possible options, each option being appropriate, partially appropriate or inappropriate and there were assigned scores of two, one and zero, respectively. The items were drawn from inventories developed by Jacobs and Paris (1987), McLain, Gridley and McIntosh (1991), Miholic (1994), and Schraw and Dennison (1994). Four aspects of metacognition in reading were measured, namely monitoring (17 items), planning (6 items), evaluation (7 items) and conditional knowledge (5 items). Monitoring refers to the assessment of one's reading strategies and how these are used, how the strategies are used to correct performance errors, and how the strategies are used to process information more

efficiently. Planning refers to the planning, goal setting and allocating of resources prior to reading. Evaluation refers to the analysis of performance and strategy effectiveness after an episode of reading, and finally, conditional knowledge refers to when and why strategies are used.

Inventory II (MII): This inventory consisted of 114 items with responses scored on a 5-point Likert scale (Always=4, Often=3, Sometimes=2, Seldom=1, Never=0). The items were derived from the respective questions and response options from MI and were grouped into three sets of 38 items randomly. The frequency by which the students applied the four aspects of metacognition, namely, monitoring (49 items), planning (16 items), evaluation (28 items) and conditional knowledge (20 items), during reading was measured by this inventory. The three sets of items were administered separately to ensure the students would not be overloaded, thus influencing their performance.

Design

The study had a mixed design. The independent variables were: (1) students' language background, ED or END; (2) students' educational level, P5, S1 or S3; and (3) academic stream: EM1, EM2 for primary students; and SAP, Express or Normal Academic for secondary students. The dependent variables were: (1) scores for SDRT, comprehension, vocabulary and scanning; (2) scores for MI; and (3) scores for MII.

Procedure

The study first involved the categorizing of students into ED or END through the administration of two questionnaires (English Dominant and Chinese Dominant questionnaires). This was followed by the completion of the SDRT. Subsequently, the metacognitive inventory (MI) was administered. This was followed by metacognitive inventory (MII), presented as three sets of items in three separate sittings. The experimenter presented the instruments with verbal instructions, worked through two examples with the students, and attended to questions posed by them before they proceeded with completing the tasks. The students were encouraged to complete all questions on each task. They were advised to do their best if they had difficulties.

Results and Discussion

Due to the unbalanced distribution of ED and END students across the streams, shown in Table 1, the following analyses excluded the consideration of stream effects. Table 2 presents the means on the SDRT comprehension test of the ED and END students from the respective educational levels. The ED readers at each educational level generally seemed to perform better than the ENDs during the reading comprehension test.

Table 2
Means of ED and END students from respective educational levels on the SDRT comprehension test

	Primary 5		*Secondary 1*		*Secondary 3*	
SDRT	*ED*	*END*	*ED*	*END*	*ED*	*END*
Scores	43.55	37.24	40.12	43.56	39.27	38.09

Scores for the SDRT as well as both sets of the inventories were computed using t-tests. It was found that the P5, S1 and S3 students did not perform significantly different on the SDRT comprehension test ($t = -0.61$, $p > .05$; $t = 1.41$, $p > .05$; $t = 1.75$, $p > .05$). Differences were however observed for the SDRT vocabulary tests, with the S1s performing better than the P5s ($t = -2.28$, $p < .05$), and S3s scoring higher than the P5s ($t = 2.18$, $p < .05$). Interestingly, the S1s performed better than the S3s ($t = 3.89$, $p < .01$). Similarly, significant differences were found between the P5s and S3s, with S3s curiously scoring less than the P5s ($t = 3.57$, $p < .01$) and the S1s ($t = 3.33$, $p < .01$), for the SDRT scanning test. No differences were however found between the P5 and S1s ($t = 0.152$, $p > .05$). The type of task concerned seemed to lead to different performance of the students in the various educational levels. It was not the case that the older the student the better they performed in the respective tasks. In addition, S3s, especially those in the normal academic stream, commented about difficulties with comprehending the test passages and with interpreting the accompanying questions, especially the inferential ones.

Analyses on the SDRT comprehension, vocabulary and scanning tests did not show that the EDs performed better than the ENDs as predicted. No significant differences were found between ED and END students for the comprehension ($t = -1.99$, $p > .05$), vocabulary ($t = -0.42$, $p > .05$) and scanning ($t = -1.44$, $p > .05$) tests. The results did not lead to any distinction between the language background of the students, nor any relationships with their performance on the reading test. This disputes the findings by Wong and Underwood (1996) that ED students performed better in reading tests than the ENDs. The distinction between the ED and END students may have failed to become apparent due to the selection criteria which resulted from a limited pool of students. Re-examination of their performance with a stricter criteria of selection, e.g., ED students speaking the English language 60–65% of the time and speaking other languages 35-40% of the time, would have led to some distinctions between the ED and END students.

Table 3
Means of ED and END students from the respective educational levels on Metacognitive Awareness Inventory I (MI)

	Primary 5		*Secondary 1*		*Secondary 3*	
	ED	*END*	*ED*	*END*	*ED*	*END*
MI Total	51.1	49.22	49.14	46.67	50.15	48.9

The means in table 3 suggest that the ED students, regardless of educational level, seemed to apply more appropriate strategies than the END students. Analyses of the scores for all categories of MI were computed. A significant difference between the ED and ENDs was found for their application of planning strategies ($t = 2.94$, $p < .05$). The ED students generally applied more appropriate planning strategies than the ENDs. The prediction that EDs apply more appropriate strategies, more specifically, planning strategies was supported. However, this was not found for the EDs for monitoring, evaluation and application of conditional knowledge.

Comparisons of the total scores of MI between the P5s, S1s and S3s level showed no differences ($t = 1.95$, $p > .05$; $t = .27$, $p > .05$; $t = -1.43$, $p > .05$). Analyses computed on

the subcategories of the inventory for educational level did, however, reveal some differences that are consistent with the predictions. The P5s and S1s ($t = 2.27$, $p < .05$), and the P5 and S3s ($t = 2.57$, $p < .05$) showed significant differences in the extent to which planning strategies were applied. The P5s planned less appropriately than the S1 and S3s. In addition, the P5s and S3s applied evaluation strategies differently ($t = -3.51$, $p < .01$), with the S3s applying more appropriate strategies. Yet another difference observed between the P5s and S1s was found with their application of conditional knowledge ($t = 3.49$, $p < .01$), for which the S1s were found to apply this more appropriately. No differences were observed between the P5s and S1s compared with the S3s. While the S3s seemed to apply more appropriate planning and evaluation strategies, they did not differ from the P5s and S1s in their application of conditional knowledge.

Table 4
Means of ED and END students from the respective educational levels on Metacognitive Awareness Inventory II (MII)

	Primary 5		*Secondary 1*		*Secondary 3*	
	ED	*END*	*ED*	*END*	*ED*	*END*
MII Total	268.86	277.62	289.87	244.99	234.83	269.76

Table 4 presents the means for MII for the ED and END students in the respective educational levels. It is observed that the pattern of scores for the EDs and ENDs at S3 level is similar to that for the ED and END students at P5 level. Analyses of the scores for all categories of MII were computed and no differences were found across the P5, S1 and S3 students. Thus, although the findings of MI demonstrated that the P5s, S1s and S3s differed in their choice of appropriate planning and evaluation strategies, as well as their application of conditional knowledge, differences in the frequency of application of metacognitive strategies by the students in the three educational levels were not found.

Differences were however revealed between the ED and END students with respect to the area of planning ($t = 2.363$, $p < .05$), with the EDs showing a greater extent of planning than the END students. Thus, as found with MI, the EDs not only demonstrated greater choice of appropriate planning strategies than the ENDs, but also tended to plan more frequently than the END students. A similar pattern of results was found with the application of conditional knowledge ($t = 3.202$, $p < .05$). The ED students demonstrated an overall greater extent of such application than the ENDs. Finally, the EDs scored higher overall total scores for MII ($t = 2.36$, $p < .05$) than the ENDs. This suggests that the ED students' overall frequency of application of the metacognitive strategies was higher than that by the ENDs. Nevertheless this could not explain their performance in the SDRT tests.

Conclusion

The predictions that the ED students would demonstrate greater application of the appropriate strategies and apply the strategies more frequently than the END students was only partially supported. The EDs generally applied the metacognitive strategies more frequently than the ENDs, though differences in their choice of strategies only arose with that for planning, but not with the other types of metacognitive strategies. The prediction

that the older the student, the more adept they are in their application of strategies was also not entirely supported. No differences were found across the educational levels with respect to monitoring strategies. Students at higher educational levels did not necessarily apply more appropriate strategies or apply the strategies more frequently.

A methodological problem lies with the use of the survey method. The students may have indicated what they felt they should do instead of what they actually do. A possible means to counteract this would be to put them through a think-aloud task. An extension of the study with an increase in the subject pool may be necessary, so that a more stringent selection criteria of the ED and END students could be applied.

Finally, having participants from various educational levels and schools suggest that they would have been exposed to different degrees of strategic teaching which results in differences in the students' levels of skill, will, self-regulation and how they perform during the task of reading. This explains such discrepancies to the predictions like the S3s showing no differences in their application of conditional knowledge when compared with the P5s and the S1s. Furthermore, many reading curricula place emphasis on the product of reading (i.e.,the interpretation), rather than the process of reading (i.e., construction of an interpretation). The study could examine the instructional styles adopted by English language teachers of the present pool of students studied and consider the teachers' influence on the students' application of metacognitive strategies.

References

Flavell, J.H. (1987). Speculations about the nature and development of metacognition. In F. Weinert, & R. Kluwe (Eds.), *Metacognition, Motivation, and Understanding* (pp.21-29). Hillsdale: Erlbaum.

Garner, R. (1987). *Metacognition and reading comprehension.* Norwood : Ablex.

Gopinathan, S. (1998). Language Policy Changes 1979-1997: Politics and Pedagogy. In S. Gopinathan, A. Pakir, W. K. Ho, & V. Saravanan (Eds.), *Language, Society and Education in Singapore: Issues and Trends*. Singapore: Times Academic Press.

Hacker, D.J. (1998). Self-regulated comprehension during normal reading. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in Educational Theory and Practice.* New Jersey: Lawrence Erlbaum Associates, Inc.

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: Issues, definition, measurement and instruction. *Educational Psychologist, 22 (3&4),* 255-278.

Karlsen, B. & Gardner, E.F. (1995). *Stanford Diagnostic Reading Test*. Harcourt Brace Jovanich : USA.

McLain, K. V. M., Gridley, B.E., & McIntosh, D. (1991). Value of scale used to measure metacognitive reading awareness. *Journal of Educational Research, Vol. 85, No.2,* 81-87.

Miholic, V. (1994). An inventory to pique students' metacognitive awareness of reading strategies. *Journal of Reading, 38, 2,* 84-86.

Palincsar, A.S. & Ransom, K. (1988). From the mystery spot to the thoughtful spot : The instruction of metacognitive strategies. *The Reading Teacher*, 784-789.

Schraw, G. & R.S. Dennison (1994). Assessing Metacognitive Awareness. *Contemporary Educational Psychology, 19,* 460-475.

Sim, W. K. & Lee, M. F. (1992). Singapore pre-schooler: how much do we know about them? In P. S. Ko, & W. K. Ho (Eds.), Growing up in Singapore: The preschool years. Singapore: Longman Publishers.

Wray, D. (1994). Comprehension monitoring, metacognition and other mysterious processes. *Support for learning, Vol . 9, No. 3,* 107-113.

Wong, M.Y. & Underwood, G. (1996). Do bilingual children read words better in lists or in context ? *Journal of Research in Reading, Vol. 19, Iss. 1,* 61-76.