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Student Learning Style and Preferences for the Promotion of Metacognitive Development Activities in Science Class

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Abstract: The promotion of students' metacognitive skills will help develop self-directed learners who possess a very important characteristic for lifelong learning. Past studies have suggested a framework to promote metacognitive development in the classroom. This study aims to identify any differences by preferred learning style in student's preferences regarding strategies to promote metacognitive skills development in the classroom. The study sample consisted of 161 science-stream students from six secondary schools in Malaysia. Two instruments were used to collect the data on the student's learning style and their strategic preferences for promoting metacognitive skills development in their Science Classes. The data were analysed descriptively using SPSS v 18.0 Overall, the study showed that the most preferred metacognitive development activities regardless of dominant learning style were emotional support, teacher's encouragement and motivation and students voice (the feeling that student's own voice was being heard) respectively. The results indicated that students need encouragement and support from teachers to develop their metacognitive skills.

Key words: Learning styles · Teaching strategy preference · Metacognitive development · Metacognitive skills

INTRODUCTION

The ability to be metacognitive - to be able to monitor and regulate one' own learning is an important aspect of the lifelong learning process. Metacognitive skills refer to the ability to monitor one's current level of understanding and decide when it is not adequate [1]. This will motivate the individual to seek the information needed. The importance of metacognition in the learning process is illustrated by a series of experimental studies designed to assess the impact of metacognitive skills on learning performance across many disciplines [2]. The results of these studies supported the presence of a positive correlation between metacognitive skills and student performance.

In terms of science classess, past studies have reported the importance of metacognition in science education [3-6]. They have indicated that it is important to improve metacognitive skills, including (among others): (i) the understanding of science concepts, (ii) the ability to undergo conceptual change, (iii) problem-solving skills and (iv) learning motivation. In addition, past studies have provided evidence that metacognition plays an important role in improving student achievement in science [7-10]. At the same time, researchers have also reported that identification of student learning style can be used to support and guide learning [11-13]. Research shows that learning styles should be used as a guide when applying metacognitive strategies. Therefore, the use of different learning styles should be taken into account. This study aims to examine students' preferences in term of metacognitive development activities in the classroom according to their learning styles.

Metacognitive Skills: Metacognitive skills are knowledge about one's own learning process [14]. The term also refers to an individual's awareness, evaluation and regulation on their own thinking activity. In other words, people with strong metacognitive skills can control and manage their own thinking and the outcome of their thinking process [15]. It is hypothesised that students' knowledge about their own thinking processes will help them solve problems effectively [16].

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There are three basic metacognitive skills that can help the process of learning, namely: 1) *planning* skills, 2) *monitoring* skills and 3) *evaluation* skills. It is believed that students who have adequate metacognitive skills will be able to plan and monitor their progress during the learning process and make changes or modify the strategies they use if they are found ineffective. It was asserted by [17] that metacognition is an important component of effective learning because it enables individuals to plan, monitor and regulate their cognitive performance. Metacognitive skills allow students to select and invent strategies explicitly by thinking about and assessing their understanding of a task's demands, their available cognitive resources and their prior experience solving similar problems [18]. The metacognitive approach has been identified as one method that can be used to develop students' study skills and metacognitive skills [19-22]. The metacognitive approach uses strategies that emphasises the development of skills to help one plan, monitor and evaluate one's own learning process. One important feature of this approach is an emphasis on the learning process in the classroom. Emphasising the learning process means engaging in activities that make the learning process explicit and visible to students.

Promotion of Metacognitive Development in the Classroom: Teachers can help in the development of students' metacognitive skills. It is proposed that teachers can enhance students' metacognitive skills by giving directions and explaining to them how to think about what they do [23]. The teacher should help student to think about how they learn and factors that inhibit the effectiveness of their learning process. In addition, teachers should also help students identify how they can improve their learning process and become a more efficient and competence learners. It was claimed by [21] that metacognitive skills can develop as students learn the subject matter in the classroom. In other words, learning skills can develop in the process of teaching and learning in the classroom. [21] suggested seven teaching and learning activities that can be used to foster students' metacognitive development.

Metacognitive development activities in this study are the seven activities as proposed by [21], namely:

1) Metacognitive Reflection: Reflection on one's cognition indicating a conscious effort on the part of teachers to guide students to think about how they learn. For example, a teacher could ask the students how they solve a task and what difficulties they faced while studying. Teachers could also ask students to try to learn a method or technique,

2) Student-student Discourse: Interaction among students including how they talk about a variety of learning styles. For example students might discuss how they learn, different ways to learn and how to improve the way they learn

3) Student-teacher Discourse: Interaction between teachers and students focusing on how they can improve their learning outcomes,

4) Student's Voice: The views of students articulate the opportunities created so that students realise the advantage in asking teachers about why they need to do certain activities in the classroom. Students can also can suggest other learning activities and voice their opinions about factors that hinder their learning,

5) Distributed Control: The collaborative efforts of teachers and students to plan a course of study so that students can grow as independent learner. For example, students might be given the authority by the teacher to plan what needs to be studied, determine what activities they will do and set aside the time required to perform these activities,

6) Teacher Encouragement and Support: Teacher efforts to improve students' learning processes. For example teachers may motivate students to try to improve the way they learn, looking for and evaluating different ways of learning. The teacher also supports efforts to understand new methods of learning and motivates students to discuss how they learn,

7) Emotional Support: Specifically emotional support given by teachers to students. For example, in the classroom teachers should treat students fairly, appreciated their efforts, respect their ideas, respect individual differences and promote trust.

Learning Style: Learning style is an important factor influencing the way students approach learning. It is suggested that teachers should identify student learning styles in order to accommodate their needs and promote effective teaching and learning processes. Learning style refers to the different and possibly unique ways different

individuals learn. Understanding and recognising student learning styles can help us understand the issue of differences in learning styles. One study [24], divided learning styles into four categories: 1) visual, 2) auditory, 3) tactual and 4) kinesthetic.

An *auditory* student learns by listening to spoken words and verbal instructions, especially when receiving new information. Written information has little meaning for them. They can reinforce their memory for learned information by listening to audio-tapes, tutoring other students and discussing material with the teacher. Meanwhile, a *visual* student prefers information presented in visual form. They remember and understand better through reading. During lecture or discussion, these students prefer to take notes to understand the material. A *tactual* student learns more effectively through hand-on activities such as experiments, lab-work and building models. Physical movement in the classroom also helps students understand new information. A *kinaesthetic* student learns better through physical experience and active involvement in learning activities, such as field trips and role-play. A combination of stimuli, such as audio tapes of activities can also help kinaesthetic students understand new things.

Research shows that learning styles should be used as a guide when applying teaching strategies. Therefore, understanding the perception of students with different learning styles should be pursued to facilitate student learning.

Methodology: This study is a descriptive study using a self report questionnaire to gather information to answer the research questions.

Participants: A total of 161 secondary-school students from four sub-urban schools in Malaysia (71 males and 90 females) were involved in this study. The average age of the respondents is 16 years old. Data were collected to measure students' learning styles, perceptions of metacognitive development activities in the classroom and preferences regarding metacognitive development activities in the classroom.

Instrument: Two survey instruments were used in this study: i) An instrument to measure students perceptions of the implementation of metacognitive development activities in the classroom and ii) An instrument to determine the respondents' learning styles.

Instrument to measure students' perception and preferences of strategies to promote metacognitive development in the classroom: This questionnaire contained 45 items based on metacognitive strategies proposed by the Curriculum Development Centre in Malaysia [25-31]. For each item, students were asked to rate their perception of the activity and also their perception of a strategy based on a five-point Likert scale.

Instrument to Determine Learning Style: This questionnaire composed of 20 items aimed at determining the types of learning styles of the respondents. These items are related to the students' tendency towards visual, auditory, tactual or kinaesthetic as set out in [24]. The tendency of a student to a particular learning style is shown by the highest scoring style.

RESULTS AND DISCUSSION

Table 1 shows the distribution of the sample according to learning style. The respondents were divided to the four learning styles according to their highest score as measured by the learning styles inventory.

The Promotion of Metacognitive Development in the Classroom: The study showed that the highest mean score reported for the implementation of metacognitive-development strategies in the classroom were for activities related to emotional support, supporting students' voices and teacher encouragement and motivation (See Table 2). The same rank was shown for each of these. However, the results also showed that the mean scores for student preference for these approaches were higher than the means for their perception of the actual implementation of the activities. These results indicate that the implementation of these activities in the classroom is still lacking.

Students' Preferences for Metacognitive-development Activities in the Classroom by Learning Style: Table 3 shows means and standard deviations for student preferences according to their preferred learning style. Figure 1 shows preferences regarding seven metacognitive-development activities, categorised according to their dominant learning style. Overall, the three most preferred strategies were emotional support, students' voices and teacher encouragement and support, in that order.

Further analysis showed that emotional support was rated the highest of all activities by all learning styles and rated the highest overall by kinaesthetic students, followed by tactical, visual and auditory students, in that order. All the other activities showed a similar trend to one another, with the highest scores among tactical

Table 1: Distribution of the Sample According to Learning Style

Learning Style	Male	Female	Total
Visual	19	18	37
Auditory	14	31	45
Tactical	19	18	37
Kinaesthetic	19	23	42
Total	71	90	161

Table 2: Mean and Standard Deviation of Students' Perception and Preferences of the Implementation of Metacognitive-development Activities in the Classroom

	Perception		Preferences	
	Mean	SD	Mean	SD
Metacognitive Reflection	4.00	0.73	4.02	0.51
Student-Student Discourse	4.02	0.76	4.13	0.65
Student-Teacher Discourse	4.01	0.67	4.13	0.71
tudent Voices	4.39	0.51	4.40	0.54
Distributed Control	3.78	0.78	3.90	0.61
Teacher encouragement and motivation	4.21	0.63	4.29	0.66
Emotional support	4.48	0.54	4.56	0.62

Table 3: Mean and Standard Deviation of Student Preferences Regarding Metacognitive-Development Activities in the Classroom, by learning style.

	Visual		Auditory		Tactical		Kinaesthetic	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Metacognitive Reflection	4.04	.668	3.94	.614	4.09	.631	4.00	.568
Student-Student Discourse	4.01	.712	4.07	.731	4.22	.594	4.22	.578
Student-Teacher Discourse	4.16	.672	3.98	.609	4.30	.522	4.07	.602
Student Voices	4.45	.612	4.30	.436	4.47	.574	4.36	.562
Distributed Control	3.88	.698	3.71	.721	4.12	.645	3.91	.743
Teacher Encouragement and Motivation	4.34	.687	4.19	.687	4.38	.510	4.25	.677
Emotional Support	4.49	.593	4.46	.520	4.53	.496	4.75	.401

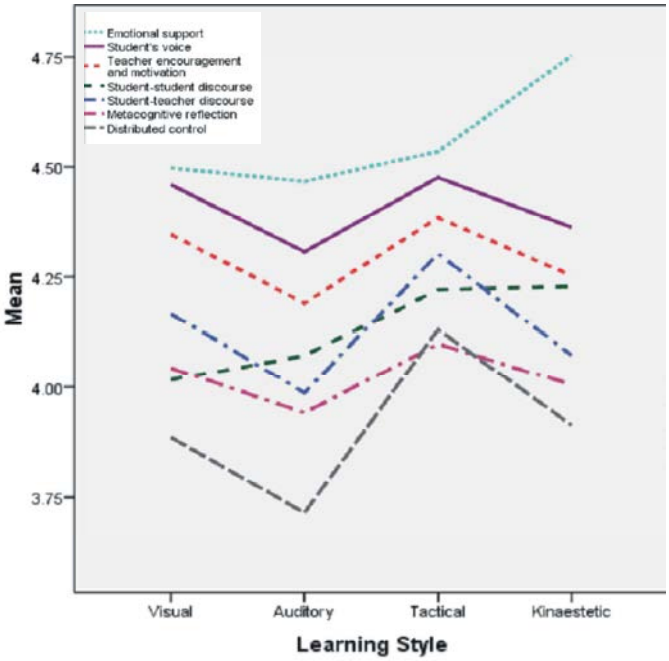

Figure 1: Preferences in metacognitive-development activities by learning style

students, followed by visual, kinaesthetic and auditory students, in that order. Thus, the auditory students reported the lowest score for all the activities.

CONCLUSION

Students should be encouraged to be actively involved in learning and should be taught to plan, monitor and evaluate what they have learned to promote their metacognitive development, which is important for the lifelong learning process. This study concludes that students, regardless of their learning style, showed preference for three strategies to promote their metacognitive development in the classroom, as outlined above. It is not clear whether cultural factors impacted these preferences; this will need to be explored in future research.

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