COMPARISON BETWEEN THE THINKING STYLES OF STUDENTS IN A SCIENCE SCHOOL AND A NORMAL SECONDARY SCHOOL

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Abstract: This study investigated the thinking styles of gifted science students and non-gifted students and examined whether the thinking styles based on Sternberg's (1988, 1997) theory of mental self-government could predict their achievement in science. The sample consisted of 145 gifted Year 7 students from a Science College and 242 non-gifted Year 7 students from a mainstream school in Brunei Darussalam. In this study, the Sternberg-Wagner Thinking Styles Inventory (Sternberg, 1997) was used. Results showed that there were statistically significant differences in thinking styles between gifted science students and non-gifted students. On analysis using the standard multiple regression procedures, it was found that the subscales of thinking styles could be significant predictors of achievement in science. Furthermore, there were also significant differences in the thinking styles between male and male and between female and female students from both types of schools. The paper concluded with the implications and limitations of the study.

Introduction

Recognising the importance of science and technology as the driving force to move the country forward, a Science College was set up in 1982 with the main purpose of inculcating young talented individuals into the field of science and technology. Unlike the mainstream schools, the school is well equipped, has a smaller number of students in each class and has an effective teaching force with a high level of professionalism. Enrolment is highly selective and limited only to high-achieving students who obtain 5 Grade A's in Science, Mathematics, General Studies, English language and Malay language in the Primary School Assessment, a public examination for the 11^{+} year olds. Those admitted will continue their secondary education for up to seven years. Over the years the school has consistently produced students with outstanding academic achievement and so much so that students from this school are over-represented among the recipients of scholarships awarded by the State Government to further their studies overseas at postsecondary or university level. Because of the competitive admission criteria and the notable features of the school, the Science College is in essence an elite school catering for the *crème de la crème* or gifted students.

Astonishingly, despite its academic success, this unique educational institution remains largely outside the gaze of educational researchers. Interests have been far and between as only three research studies had been conducted on this school thus far. These are: Yong (2005) investigated upper Year 11 students' perceptions of the classroom learning environment and teacher interactions in biology classes; Fauziah (2006) evaluated Years 7 and 8 students' science skills; and Yong (2010) investigated Year 9 students' verbal, abstract and spatial reasoning abilities.

Elsewhere, numerous comparative studies had been carried on students in the elite schools and they appeared to have different attributes than their counterparts in the mainstream schools. The succeeding sections highlighted some of the attributes that are distinctive of them. An inherent trait, and perhaps the most important, that distinguishes students in the elite schools is their high achieving potentials due to their exceptionally high cognitive abilities (Colangelo, Kerr, Christensen & Maxey, 1993; Toomela, Kikas & Mottus, 2006; Vlahovic-Stetic, Vidovic & Arambasic, 1999). Another reason for the high academic success of elite schools is largely due to

the presence of a disproportionately large number of high achievers who have a high level of motivation to continue their education (Kozochkina, 2009). Furthermore, high achievers had been reported to have significant differences in intellectual ability, verbal ability, attribution of failure to stable factors and mood, academic self-concepts, attainment value, rehearsal, time management and effort management than low achievers (Lau & Chan, 2001). Another characteristic is students' interaction with their teachers in the classroom as Willson (1999) observed that high achievers were found to initiate interactions to volunteer answers, whereas the low achievers interacted purely for the purpose of help-seeking. Stoynoff (1997) studied factors associated with international students' academic achievement and found that high achievers not only have good English Language proficiency but also spent more time studying, remained up-to-date in their courses, were better at test taking skills, and were better able to select the main ideas from spoken and written discourse. In assessing the career aspirations of high-achieving secondary school students, Zaitun (2003) reported that they are well motivated, ambitious and have strong desire to be successful in their future profession. Adams (1996) reported that high achieving students have positive behaviour and hence they receive more teacher attention than other students during lessons.

Other important attributes that influence academic success are self-concepts and motivation as studies have shown that high achieving students are highly motivated because of the inter-relationships of intelligence, self-concept and self-esteem that help them to realise their scholastic potentials (Feldhusen & Hoover, 1986). Other studies had reported that high achievers have higher scores than did low achievers on academic goals, valuing science, and perceived ability (Debacker & Nelson, 2000) and they have more positive attitude toward science in terms of interest and career in science than low achieving students (Adams, 1996).

As attitude and ability do not fully explain academic success, scholars and educational researchers began to look for other additional factors to explain gifted students' achievement. One such factor that has attracted much attention in recent years is the thinking styles based on Sternberg's (1988, 1994) theory of mental self-government. Studies of gifted students based on this theory have generated some important findings. In the first instance, Sternberg and Grigorenko (1993) considered the interaction between styles of thinking and giftedness in children and observed that gifted children were more legislative, judicial and liberal than non-gifted children when carrying out their tasks. In Korea, Park, Park and Choe (2007) reported that not only gifted students have higher scores in scientific giftedness, they were also found to prefer the legislative, judicial, anarchic, global, external and liberal thinking styles whereas non-gifted students preferred executive, oligarchic and conservative styles. Kim, Seo, Kim and Lee (2007) investigated gifted IT students' thinking styles and found that they tended toward legislative, judicial, global, internal and liberal thinking styles, and these findings concurred with those reported by Yun (2005) and Lim (2006) in their separated studies of gifted IT students in Korea. One observation that can be deduced from these studies is that the thinking styles of gifted students are very similar irrespective of their learning areas.

When gifted students were classified according to Zhang's (2003) thinking type model, they appeared to belong to the Type 1 thinking styles. Similar observation was reported by Alborzi and Ostovar (2007) when they examined the thinking styles of junior high school students in Iran and found that gifted students scored significantly higher than non-gifted students on Type 1 and Type 3 thinking styles, while non-gifted students had statistically significant higher scores on Type 2 thinking styles. In her attempt to further conceptualise the 3 thinking types, Zhang (2003, 2004a) describes Type 1 thinking styles as those having the tendency to be more creativity-generating and denote higher levels of cognitive complexity. In other words, they manifest positive attributes such as a deep approach to learning, high cognitive developmental levels, holistic modes of thinking, and an open personality. On the other hand, Type 2 thinking styles is described as those having the tendency to be norm-favouring, and denote lower levels of cognitive complexity. Those with Type 2 manifest negative attributes such as low self-esteem,

low cognitive developmental levels, analytic modes of thinking, and neurotic. And Type 3 thinking styles may display the characteristics of either Type 1 or Type 2 thinking styles.

Research on thinking styles has now become fully established in the educational realm. Evidence emerged from over a decade of research "has clearly and consistently indicated that thinking styles have significant predictive power for students' academic performance" (Zhang, 2004a, p. 560). It is based on this premise that the present study was undertaken. The purpose of the present study was to explore gifted and non-gifted secondary students' thinking styles based on the theory of mental self-government (Sternberg, 1988). The study addressed the following research questions:

1. Are there any relationships between students' thinking styles and their achievement in science?
2. Are they any significant differences in thinking styles between gifted and non-gifted students?
3. Are they any significant differences in thinking styles between gifted and non-gifted male students?
4. Are they any significant differences in thinking styles between gifted and non-gifted female students?

Method

Sample

The sample of the study was Year 7 students from a Science College and a mainstream secondary school in Brunei Darussalam. Of the 142 students who took part from the Science College, 70 were males (49.3%) and 75 were females (50.7%). There were 242 students from the mainstream school and of them 120 were males (49.6%) and 122 were females (50.4%). The average age of the students was 12.6 years, ranging from 12 to 13 years.

Questionnaire

The questionnaire consisted of two parts: Part 1 was to find out students' demographic information such as gender, age, grade level, marks that they obtained in their last science test.

Part 2 consisted of the Sternberg-Wagner Thinking Styles Inventory (Sternberg, 1997). The original version consisted of 104 items and of which only 78 items were chosen after the structure of the language of the items were carefully considered. The 78 items were categorised into thirteen characteristics or scales with 6 items in each scale. The items were arranged in a cyclic order in the questionnaire. The students were asked to indicate the extent to which the statements described the way they like or prefer to accomplish a task. The response options were 1-7 point Likert scale with (1) Not at all like me, (2) Not very much like me, (3) Slightly like me, (4) Somewhat like me, (5) Like me, (6) Very much like me and (7) Extremely like me. The thirteen thinking styles are categorised into five dimensions and each has several characteristics or scales The dimensions are functions (legislative, executive, judicial); forms (monarchic, hierarchic, oligarchic, anarchic); levels (global and local); scopes (internal, external); and leanings (liberal, conservative). The details are presented in Table 1.

Data Collection

The questionnaires were given to the Heads of the Science Department of the schools who distributed them to respective teachers responsible for teaching science to Year 7 students. Students were given 15 to 20 minutes to complete the questionnaires during one of the science lessons.

Table 1
Sternberg's Thinking Styles adapted from Betoret (2007) Dai & Feldhusen (1999) and Zhang (2001)

Thinking styles		Key characteristics	Tasks preferred	Sample item
Functions	Legislative	Like doing things in their own way. They prefer to work on tasks that require creative strategies *(Being creative).*	Like doing science project, writing poetry, stories or music, and creating original artworks.	When making decisions, I tend to rely on my own ideas and ways of doing things.
	Executive	Like to be told what they should do or how they should do it. They prefer to work on tasks with clear instructions and structures *(Being conforming).*	Like to solve problems, write papers on assigned topics, do artwork from models, build from designs, learn assigned information.	I am careful to use the proper method to solve every problem.
	Judicial	Prefer tasks that enable them to analyse, judge, and evaluate things and ideas *(Being analytical).*	Like to critique work of others, write critical essays, give feedback and advice.	When discussing or writing down ideas, I like judging other peoples' ways of doing things.
Forms	Monarchic	Prefer to work on tasks that allow complete focus on one thing at a time *(Deal with one task at a time).*	Like to immerse self in a single project, whether art, science, history	I like to concentrate on one task at a time.
	Oligarchic	Prefer to work on multiple tasks in the service of multiple objectives, without setting priorities *(Deal with multiple non-prioritised tasks).*	Like to devote sufficient time to reading comprehension items so may not finish standardised verbal ability test.	When I have several tasks to do, I usually start working on them all at once.
	Hierarchical	Like to priotise tasks and distribute attention to them according to their value *(Deal with multiple prioritised tasks).*	Like to budget time for doing homework so that more time and energy is devoted to important assignments.	I like to set priorities for the things I need to do before I start doing them.
	Anarchic	Prefer to work on tasks without norms and instructions. They like flexibility about what, where, and how to work *(Deal with tasks at random).*	Write an essay in stream of consciousness form in conversation, jump from one point to another, start things but don't finish them.	When I have many things to do, I do whatever occurs to me first.

Data Analysis

Data were analysed using the SPSS statistical computer package (Statistical Package for the Social Sciences, version 9, 1997). Several procedures, including reliability analysis, frequency, mean, and standard regression coefficients were performed to summarise the findings. The classification of students into five thinking style dimensions followed the same procedure as those described by Richmond, Krank and Cummings (2006). In this method, student's highest

score for a given dimension was chosen to represent that dimension. For example if someone's scores were Judicial = 4.5, Legislative = 6.2 and Executive = 3.1, they would be catgorised as a *Legislative* thinker. The process was performed on all five Thinking Style Dimensions.

Table 1
(Continued)

Thinking styles	Key characteristics	Tasks preferred	Sample item
Levels Local	Local people prefer to work with details. They tend to notice the trees more than the forest *(Focus on concrete ideas).*	Write an essay describing the details of a work of art and how they interact.	I prefer to deal with specific problems rather than general questions.
Global	Prefer to deal with wide and frequently abstract questions. They tend to see the forest more than the trees *(Focus on abstract ideas).*	Write an essay on the global message and meaning of a work of art.	I like situations and tasks in which I am not concerned with details.
Scopes Internal	Are usually introverted, reserved people with fewer social connections than others, as a result, prefer to work alone *(Enjoy working independently).*	Prefer to do science or social studies projects on their own.	I like to control all phases of a project, without having to consult others.
External	Tend to be extroverted, open, and with greater social and interpersonal inclinations *(Enjoy working in groups).*	Prefer to do science or social studies project with other members of a group.	When starting a task, I like to brainstorm ideas with friends or peers.
Leanings Liberal	Prefer to work on tasks that involve novelty and ambiguity *(Use new ways to deal with tasks).*	Prefer to figure out how to operate new equipment event if it is not the recommended way, prefer open-classroom setting.	I enjoy working on projects that allow me to try new ways of doing things.
Conservative	Prefer to work on traditional tasks that must follow similar rules and procedures to those previously used *(Use traditional ways to deal with tasks).*	Prefer to operate new equipment in traditional way, prefer traditional classroom setting.	I like to do things in ways that have been used in the past.

Achievement in Science

Students' achievement in science was determined by the marks that they obtained in their last tests.

Results and Discussion

Reliability and Discriminant Validity of the Instrument

Cronbach's alpha coefficients and mean partial correlation coefficients were calculated to estimate the internal consistency and discriminant validity of the items in each scale of the

thinking style instrument. Values obtained for alpha coefficients ranged from 0.51 to 0.73 which indicated that each scale displayed adequate internal consistency. These values are similar to those reported by Grigorenko and Sternberg (1997) which ranged from 0.55 to 0.83 and those obtained by Bernardo, Zhang and Callueng (2002) which ranged from 0.50 to 0.81 Values obtained for discriminant validity ranged from 0.08 to 0.11 which suggested that each scale is relatively distinctive of other scales though there was a small degree of overlapping occurring between each scale. Based on these data, the reliability and validity of instrument were considered adequate and suitable for the purpose of the study.

Achievement in Science

The results in Table 2 showed that gifted students in the Science school performed much better in science than non-gifted students in the mainstream school. This was reflected in the overall mean scores and the man difference was significant (p<0.000; ES = 0.93).

Table 2

Achievement in Science between Students in the Science School and Mainstream School

School	Mean	SD	*t*-value	*p*	ES
Science	81.98	8.98	7.087	0.000	0.93
Mainstream	68.73	19.56			

Science sch=145; mainstream sch=242; SD=standard deviation; ES=effect size

Table 3

Relationships between Thinking Styles Characteristics and Achievement in Science in terms of Standard Multiple Regression Coefficients (ß)

Dimension	Characteristic	*ß*
Functions	Legislative	0.045
	Executive	0.168
	Judicial	0.077
Forms	Monarchic	0.186*
	Oligarchic	-0.101
	Hierarchical	-0.317**
	Anarchic	-0.077
Levels	Local	0.162*
	Global	-0.168*
Scopes	Internal	-0.052
	External	0.049
Leanings	Liberal	0.136
	Conservative	0.028
Multiple *R*	0.400***	
R^2	0.160	

*P<0.05; **p<0.01; ***p<0.001; N=406

Relationships between Thinking Styles and Achievement in Science

The relationships between thinking styles and achievement were examined using standard multiple regression procedure, with students' achievement as the dependent variable and their thinking styles as their independent variables. The summary statistics of the analysis are shown in Table 3. Results showed that of the 13 thinking style characteristics four thinking styles contributed statistically. There were the monarchic and local thinking style which contributed positively, and the hierarchical and global thinking styles which contributed negatively to achievement in science. This suggested that all four thinking styles contributed to the prediction

of achievement scores albeit in different directions. They explained 16% of the total variance (R^2) for achievement.

Thinking Styles between Gifted and Non-gifted Students

Based on the scale mean scores of the 13 characteristics, results showed that they preferred the executive, monarchic, local, external and liberal thinking styles (Table 4). Based on Zhang's (2003) thinking type model, it appeared that both gifted and non-gifted students tended predominantly toward Type 2 thinking styles that include executive, monarchic and local thinking styles except for leaning dimension which they seemed to prefer the liberal instead of the conservative learning styles. The results did not concur with those reported by Park, Park and Choe (2005) which showed that gifted students in Korea preferred the Type 1 thinking styles whilst non-gifted students preferred the Type 2 thinking styles. Accordingly, Bruneian students, regardless of whether they are gifted or non-gifted, seemed to orient toward the characteristics of non-gifted students who preferred the Type 2 thinking styles. This can be translated to imply that Bruneian secondary students tended to be norm-favouring or tasks which demands lower level of cognitive complexity. In other words, they preferred tasks that have clear instructions and structures, tasks that allow complete focus on one thing at a time, tasks that focus on concrete ideas, and tasks that they can do cooperatively in group. Oddly, they also seemed to prefer tasks that give them new ways of solving them, that is, a liberal thinking which is characteristic of Type 1 thinking style.

The results in Table 4 also showed that there were significant statistical differences in thinking styles between these two groups of students. Of the 13 thinking style characteristics, gifted students showed a higher tendency than non-gifted students in all the thinking styles except for internal style. Specifically, in the function dimension, gifted students tended to be more conforming, more creative and more analytical than non gifted students. In form, they seemed to prefer to deal with tasks in all the different ways whether one at a time, many at a time, at random or according to priority; in level, they seemed to prefer to focus both on concrete and abstract concepts; in scope, they seemed to enjoyed more on group work; and in leaning, they seemed to prefer using both new ways and traditional ways of carrying out a task than the non-gifted students.

Table 4

Scale Means, Standard Deviations, t-values and Effect Sizes for Students' Thinking Style Characteristics in Science School and Mainstream School

	Science school		Mainstream school			
Characteristic	Mean	SD	Mean	SD	*t*-value	ES
Legislative	27.87	5.96	24.36	7.07	5.225***	0.54
Executive	28.28	5.44	25.40	7.02	4.494***	0.46
Judicial	27.28	5.33	23.71	6.55	5.836***	0.60
Monarchic	29.33	5.62	26.21	6.68	4.919***	0.51
Oligarchic	22.40	6.19	20.66	6.32	2.660**	0.28
Hierarchical	26.98	6.16	24.65	6.76	3.464**	0.36
Anarchic	27.59	5.42	24.87	6.10	4.551***	0.47
Local	25.41	4.97	23.05	6.81	3.927***	0.40
Global	22.77	4.90	20.79	5.90	3.544***	0.37
Internal	22.42	6.35	22.23	6.44	0.281	-
External	30.21	6.04	26.25	6.67	5.605***	0.62
Liberal	29.28	5.77	26.25	6.67	4.698***	0.49
Conservative	25.74	6.12	24.03	6.50	2.597**	0.27

**$P < 0.01$; ***$P < 0.001$; science sch=145; mainstream sch=242; SD=standard deviation; ES=effect size

Table 5
Scale Means, Standard Deviations, t-values and Effect Sizes for Male Students' Thinking Style Characteristics in Science School and Mainstream School

Characteristic	Science school (Male)		Mainstream school (Male)		*t*-value	ES
	Mean	SD	Mean	SD		
Legislative	27.27	6.10	24.81	6.86	2.543*	0.38
Executive	27.29	5.86	25.66	6.56	1.766	-
Judicial	26.31	5.28	23.83	6.13	2.943**	0.53
Monarchic	28.61	5.68	25.97	6.44	2.948**	0.44
Oligarchic	21.86	6.48	21.39	5.73	0.498	-
Hierarchical	25.81	6.42	24.87	6.49	0.978	-
Anarchic	26.77	5.68	24.59	5.33	2.610**	0.40
Local	24.87	5.34	23.52	6.34	1.564	-
Global	22.86	5.11	21.03	5.41	2.321*	0.35
Internal	21.99	6.68	23.34	6.10	-1.385	-
External	28.67	6.45	26.30	6.69	2.405*	0.36
Liberal	28.83	6.59	26.19	6.02	2.740**	0.42
Conservative	24.81	6.37	24.65	6.16	0.176	-

*$P < 0.05$; **$P < 0.01$; science school=70; mainstream school=120; SD=standard deviation; ES=effect size

Table 6
Scale Means, Standard Deviations, t-values and Effect Sizes for Female Students' Thinking Style Characteristics in Science School and Mainstream School

Characteristic	Science school (Female)		Mainstream school (Female)		*t*-value	ES
	Mean	SD	Mean	SD		
Legislative	28.41	5.81	23.88	7.26	4.823***	0.69
Executive	29.20	4.88	25.16	7.47	4.594***	0.65
Judicial	28.17	5.25	23.59	6.97	5.237***	0.75
Monarchic	30.00	5.52	26.45	6.92	3.970***	0.57
Oligarchic	22.91	5.91	19.93	6.79	3.234**	0.47
Hierarchical	28.06	5.74	24.44	7.05	3.938***	0.57
Anarchic	28.35	5.09	25.14	6.77	3.776***	0.54
Local	25.92	4.58	22.59	7.22	3.960***	0.56
Global	22.68	4.73	20.56	6.36	2.674**	0.38
Internal	22.83	6.05	21.16	6.60	1.818	-
External	31.65	5.28	26.24	8.42	5.501***	0.79
Liberal	29.71	4.88	26.31	7.29	3.885***	0.56
Conservative	26.61	5.79	23.41	6.79	3.504**	0.51

**$P < 0.01$; ***$P < 0.001$; science school=75; mainstream school=122; SD=standard deviation; ES=effect size

Thinking Styles between Gifted and Non-gifted Male Students

The results showed that both gifted and non-gifted male students tended predominantly toward Type 2 thinking styles. There were also significant statistical differences between the thinking styles of these two groups of male students. Of the 13 thinking style characteristics, gifted male students from the Science College showed a higher tendency than non-gifted students from the mainstream school in legislative, judicial, monarchic, anarchic, global, external and liberal

thinking styles. The findings seemed to suggest that gifted male students tended to be more conforming, more creative, more analytical, prefer to deal with tasks one at a time and according to priority, enjoy group work and prefer using new ways of carrying out a task than the non-gifted male students.

Thinking Styles between Gifted and Non-gifted Female Students

Like their male counterparts, both gifted and non-gifted female students tended predominantly toward Type 2 thinking styles. Unlike their male counterparts, the difference between female gifted and non-gifted students was greater in terms of the number of thinking styles that are statistically significant. Of the 13 thinking style characteristics, gifted female students showed a higher tendency than non-gifted female students in all the thinking styles except for internal style. Specifically, in the function dimension, gifted female students tended to be more conforming, more creative and more analytical than non gifted female students. In form, they seemed to prefer to deal with tasks in all the different ways whether one at a time, many at a time, at random or according to priority; in level, they seemed to prefer to focus both on concrete and abstract concepts; in scope, they seemed to enjoyed more on group work; and in leaning, they seemed to prefer using both new ways and traditional ways of carrying out a task than the non-gifted female students.

Conclusion

The thinking style inventory based on the Stenberg's theory of mental self-government is a valid and reliable instrument for use in research studies in Brunei Darussalam. The Cronbach alpha and discriminant validity coefficients obtained were within the range of acceptable values. Some of the items have their sentence structures simplified to suit the language ability of the students as English is not their first language for the majority of the participants.

In achievement, gifted students from the Science College seemed to outperformed non-gifted students from the mainstream school by a margin of 13 percentage point. Results also showed that there were significant relationships between thinking styles and achievement when examined using the standard multiple regression procedure. Of the four thinking styles which contributed statistically, the monarchic and local thinking style were found to contribute positively, while the hierarchical and global thinking styles were found to contribute negatively to achievement in science. Overall they explained 16% of the total variance (R^2) for achievement.

Unlike the findings reported elsewhere (Kim et al., 2007; Lim, 2006; Yun, 2005), secondary students in Brunei tended to prefer the executive, monarchic, local, external and liberal thinking styles or the Type 2 thinking model irrespective of whether they were gifted or non-gifted. An explanation for this tendency perhaps lies with the educational system and cultural expectations. In a comparative study of students' thinking styles of different countries, Zhang (2001) came to the conclusion that in order "to succeed academically in their respective cultures, students need to have a preference for certain thinking styles because each culture has its own values and each educational system has a different reward system…" (p. 632). Based on Zhang's (2001) thinking model, Bruneian students tended to prefer ways of doing things that are norm-favouring or tasks that demand lower levels of cognitive complexity. This manifestation reflects the nature and demand of the educational system which places so much emphasis on examination. Under this system, teachers resort teaching students to the test because they are under constant pressure to produce results. In order to meet that expectation, teachers will attempt to cover the syllabus quickly so that they will have ample time of a few months to drill their students to practice past exam questions. Therefore, the form of teaching approach is teacher-centred and assessment-driven with very few opportunities for students to engage in exploratory activities. Zhang (2004b) reported that when teachers use a knowledge transmission/teacher-focused

teaching approach, they tended to use Type 2 teaching styles. It seemed that the reason for Bruneian students to orient toward Type 2 thinking styles is because it fits well with what the context demands, and in this case, with the ways science is taught and assessed.

Another interesting finding of the study was the significant statistical relationships between different thinking styles and achievement. More specifically, it appeared that preference for the use of monarchic (being conforming), local (focusing on concrete ideas) and liberal (using new ways to deal with tasks) thinking styles tended to positively contribute to secondary students' academic achievement. By contrast, the use of oligarchic (dealing with multiple non-prioritised tasks) and global (focusing on abstract ideas) thinking styles tended to put students in a disadvantage position in academic achievement.

In terms of school type, gifted students from the Science College have significantly higher tendency than non-gifted students from the mainstream school all the 13 thinking styles except in internal thinking styles although both groups of students tended toward Type 2 thinking style. The same was also true when comparisons were made between gifted male and non-gifted male and between gifted female and non-gifted female students albeit in different degree. It can be reasonably assumed that gifted students tended to prefer tasks that are more challenging in terms of cognitive complexity than non-gifted students.

Implications

The implications of the study are follows:

1. As students will be more successful if they are given tasks that match with their thinking styles (Sternberg & Grigorenko, 1997) teachers should design teaching and learning methods that are best suited for the individual style of each students. Bruneian secondary students, regardless of gifted or non-gifted, seemed to prefer the Type 2 thinking styles which are characterised by the executive, monarchic and local thinking styles in the way they carry out their tasks. Based on this thinking style preference, it is suggested that expository method of teaching and tasks that are related to problem-solving where clear instructions and structures, tasks like projects where they can focus on one thing at a time and tasks that require details and precision will be more suitable for the students.
2. Since gifted students tended toward all the thinking styles, except the internal thinking style, higher than those non-gifted students, they should be given tasks that are more creative, more analytical and more challenging like projects in which they can choose the topics they want to investigate and design the methods to solve problems on their own under the advice and guided support of teachers.
3. Teachers should also use other teaching and learning programmes that reflect the diverse thinking style characteristics of the learners in both types of schools.
4. Students' thinking styles should be included in the teacher education programme. Such knowledge will enable teachers to develop effective teaching methods and pedagogical strategies to respond to the diverse thinking styles of students in science classrooms.

Limitations of the Study

The limitations of the study are as follows:

1. In this study the grades obtained by students were used as a measurement of achievement. As the grades were based on one test, they did not necessarily represent a precise indication of level of proficiency of the participants. It is recommended that the academic performance of participants should be based on results obtained from several tests and assignments.
2. More studies should be carried out before the results can be generalized for other schools. It is recommended that a similar study be conducted using the same research design with

a larger sample of participants from different schools. This will generate more credible results and obtain better and wider representation of different categories of thinking styles

In conclusion this exploratory study has generated some interesting findings with regard to gifted and non-gifted students' thinking styles. Nevertheless, more studies need to be conducted as this will undoubtedly provide researchers and teachers with a better understanding of Bruneian students' thinking styles and such knowledge will enable practitioners to offer appropriate teaching methods for effective learning of science.

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