

Relationship between Students' Cognitive Style (Field-Dependent and Field-Independent Cognitive Styles) with their Mathematic Achievement in Primary School

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Abstract: *The main purpose of this study was to examine the relationship between students' cognitive styles with student's achievement in mathematics among year 6 students from selected primary schools in Selangor (Malaysia). The methodology of study was survey. Data were collected using the Group Embedded Figures Test (GEFT). GEFT was used to identify students' cognitive styles either Field-Dependent (FD) or Field-Independent (FI). A total of 150 students in year 6 from selected schools were selected as participant of study. Data were analyzed using SPSS version 17.0. There were two types of analysis used in this study, descriptive and inferential statistical analysis. The finding showed that 112 students were of Field-Dependent cognitive styles (FD) compared to 38 students of Field-Independent (FI) cognitive styles. The study also showed that there was a low positive correlation between students' cognitive styles and their mathematics achievement. There was also a significant difference in cognitive styles between boys and girls in the school. The Ministry of Education should cautioned teachers about the importance of cognitive styles during learning and teaching process. The Mathematic teachers should take into consideration about students' cognitive styles during preparing their lesson plan and teaching aids.*

Keywords: *cognitive styles; field-dependent; field-independent; Mathematic; primary school students.*

1. INTRODUCTION

Cognitive styles have been identified to influence students' academic achievement (Henson and Eller, 1999). Slavin (2000) explained that the diversity of students can be found in the level of performance, rate of learning, cognitive style and culture. Students' cognitive styles have been identified to influence student's achievement in mathematics (Poh Bee Theen & Melissa Ng, 2008; Kim 1999).

In creating a world-class employees in the year 2023, students need to master the knowledge of Mathematics and Science. Mathematics is a subject that is difficult to learn, especially among Malay students (Isahak Haron, 2001). Secondary school students are afraid and have negative thought about Mathematics because it is difficult to understand and master (Ng See Ngean (1992). In his study, he found that 50% of the secondary school students hated mathematics because it is difficult and unattractive. One reason for the failure of students in mathematics other than intelligence and motivation were their cognitive styles (Kim 1999). Students' cognitive styles which does not match with teaching method can lead to students failing (Witkin and Goodenough, 1977; Norlia Abdul Aziz and colleagues, in 2006, John Males and colleagues, 2007).

2. STATEMENT OF PROBLEM

Study have been done by Norlia Abd Aziz, T. Subahan Meerah et. al. (2006), which showed a significant relationship between students' cognitive styles and internal motivation with their academic achievement. Also the students would get low grades in academic achievement when they fail to adapt to the way of teaching and learning in universities (Baharin Abu, 2000). As a result, many students who are less successful or failed to achieve excellent results admitted that their lack of knowledge about cognitive styles influence their grades. Therefore, this study aimed to investigate the relationship between students' cognitive styles with their academic

achievement. It is hoped that this study would help students to improve their academic performance. In addition, awareness of the importance of the interaction between these three elements (i.e cognitive style, teaching method and study environment) among teachers and students can also help the educational institutions and teachers to provide an environment and teaching methods which were more appropriate to these students (Baharin Abu, 2000).

Study by Azizi Yahya, Yusof Boon & Wan Zuraidah Wan Hamid (2002) and Azmiza (2009) found that there was no significant relationship between students' cognitive styles and their academic achievement while Ramlah and Md. Nasir (2007) and Poh & Melissa Ng (2006) found that there were positive and significant relationship between students' cognitive styles and their academic achievement. So the main objective of this study was to identify the students' cognitive styles (either Field-dependent or Field-Independent) and find out whether exist a significant relationship between students' cognitive styles and their academic achievement.

3. RELATED REVIEW LITERATURE

Herman Witkin (1977) was the first psychologists who coined the concept of field-dependent (FD) and the field-independent (FI) cognitive styles. According to Witkin and Goodenough (1977), students with field-dependent learning styles learn better in Language and History compared to field-independent students. The students with field-independent learning styles were found to learn better in Mathematic and Sciences subjects (Biology, Chemistry, Physic). Students from different cognitive styles also differed in their ways of learning. Witkin and Goodenough, 1981 (in Slavin, 2000) describes the FI students can easily separate parts from the whole pattern, while FD students tend to see things as a whole pattern and find it difficult to separate a whole pattern into parts. Students with FD orientation tend to remember friends or people's face and social aspects such as birth date. FD students like to work in group such as in cooperative learning compared to FI students who like to study independently and are better at manipulating number lessons, science facts and problem-solving.

Research done by Azizi Yahya, Yusof Boon & Wan Zuraidah Wan Hamid (2002), try to find the relationship between students' cognitive styles and their academic achievement. This research also try to identify which learning style is dominant among these students and find the relationship between family, teaching method and peers with learning style. Participant of study comprised of 120 students from two selected Secondary School in Selangor. Instrument used comprised of 80 items regarding "Learning Styles Questionnaires" (adapted from Honey and Mumford, 1992) and 30 items regarding relationship with family and peers; and teaching method preferences. Result of study showed that there was no correlation between cognitive styles and students' academic achievement ($r = 0.0$ and $r = 0.2$). The study found that dominant learning style among these student were reflector, folowed by theorist, pragmatic and lastly activist. The research found significant relationship between theorist learning style with family factors and peers; also significant with teacher's teaching method.

Study by Ramlah Jantan and Md. Nasir Masran (2007) try to find the relationship between teachers' teaching style and students' cognitive style with students' Mathematic achievement among primary school students. Participants of study consisted of 395 students (standard 3-6) with their 13 Mathematic teachers from selected schools in Perak and Selangor (Malaysia). GEFT (Group Embedded Figures Test) was used to identify students cognitive style either field-dependent (FD) or field-independent (FI) whereas 'Teaching Style Inventory' adapted from Grasha (1996) was used to identify teachers' teaching styles. The study found that there was positive and significant correlation between teachers' teaching style and students' cognitive style with their mathematic achievement. Coefficient correlation showed that the effect of teachers' teaching had greater influence than students' cognitive styles on their mathematic achievement.

Poh Bee Theen and Melissa Ng Lee Yen Abdullah (2008) try to determine the effect of gender, ethnicity and cognitive styles on achievement of form six students in General Paper. The sample comprised of 152 upper six students (60 boys and 92 girls) from a selected school in Perak. The GEFT test (Group Embedded Figures Test) was used to measure students' cognitive styles. Finding showed that 69 (45.39%) students were from field-dependent cognitive style and 83 (54.61%) students were from field-independent cognitive style. Result of t-test revealed that girls' achievement was significantly higher than boys. Result of ANOVA showed that Chinese

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students score significantly higher than Malays and Indians. Finding showed that there were positive correlation between students' cognitive style and achievement in General paper.

Alireza Jilardi Damarandi, Rahil Mahyuddin & Habibah Elias et al (2011), have studied the influence of learning style on the students' achievement among Iranian secondary school students. They used Kolb's Learning Style Inventory (1999) to identify the students' learning style and they have distributed the inventory to students in eight public secondary school in Tehran. They derived the mean score for students' achievement from average mean score for five subjects i.e English, Science, Mathematic, History and Geography. Participant of study were 285 grade ten students which were chosen randomly. Result of ANOVA showed that there were significant difference between the students with different learning style in their academic achievement especially among Assimilator students who were having high score from those students from Diverger or Acomodator learning style.

4. OBJECTIVE OF STUDY

Objective of Study:

1. To identify students' cognitive style.
2. To identify students mean score in Mathematic.
3. To study the differences in students' cognitive style among girls and boys.
4. To study the correlation between students' cognitive style and their Mathematic achievement.

5. HYPOTHESES OF STUDY

Ho1: There is no significant differences in students' cognitive style among boys and girls.

Ho2: There is no correlation between students' cognitive style and their Mathematic achievement.

6. METHODOLOGY

Methodology of study was survey and questionnaire was used to collect data from selected schools. This method was suitable for collecting data from large sample (Weirisma, 2002). Participant of study consisted of 150 students from selected primary schools in Selangor. Inventory used were 'Group Embedded Figures Test' (GEFT) which was administered to the students with the help of their class teacher. The students take one hour to complete the test given. The pilot study was conducted one week earlier from the proper data collection to find the face validity and the realibility of the instrument. Cronbach Alpha for GEFT was 0.88. This value signify that this test was suitable to be used (Weirisma, 2002) to collect data from the sample. Data were analyzed using descriptive and inferential statistics through 'Statistical Package for Social Sciences' (SPSS) version 17. Descriptive statistical analysis used were means, standard deviation, frequency and percentage. Inferential analysis used were t-test and bivariate correlation.

7. RESULT

The results were discussed below.

1. Students' Cognitive Style

According to Table 1, 112 students (74.7%) were from field-dependent (FD) cognitive style while 28 students (25.3%) were from field-independent (FI) cognitive style. These showed more students from the sample tend to be field-dependent (FD) than field-independent (FI).

Table1. Means and Standard Deviation : Students' Cognitive Style

Cognitive Style	Frequency (%)	Mean	Standard deviation
Field-dependent	112 (74.7%)	1.58	0.496
Field-independent	28 (25.3%)	1.37	0.489

2. Students' Mathematic Achievement

Table 2, showed that around 40 students (26.7%) managed to get excellent means score (A) while 38 students (25.3%) managed to get good grades (B) and 60 students (40%) got average score. Around 9 students (6%) had poor score and 3 (2%) had very poor score. These showed that 78 students (62%) manage to get good mark and 60 students (40%) manage to get average mark and 12 students (8%) failed in the exam.

Table 2. Students' Average Mean Score in Mathematic 'UPSR' 2012

	Frequency (n)	Percent (%)
A (Excellent)	40	26.7
B (Good)	38	25.3
C (Average)	60	40.0
D (Poor)	9	6.0
E (Very Poor)	3	2.0

3. The Differences in Cognitive Styles among Boys and Girls.

Table 3.1 showed that among boys, 47 (66.2%) boys were from FD and 24 (33.8%) were from FI learning styles. Among girls, 65 (82.3%) were FD and 14 (17.7%) were FI. We we can conclude that many girls tend to have FD learning styles compared to boys.

Table 3.1. Learning Style among Boys and Girls

Gender	Cognitive Style		Total
	Field-dependent (FD)	Field-independent (FI)	
Boys	47 (66.2%)	24 (33.8%)	71 (100%)
Girls	65 (82.3%)	14 (17.7%)	79 (100%)

When t-test was performed using SPSS, result showed that exist significant differences in learning styles between boys and girls at significant level $p < 0.05$. Result showed that $t(148) = 2.285$, $p = 0.024$ ($p < 0.05$). Hypotheses null was rejected.

Table 3.2. Result of T-Test Differences In Cognitive Styles Based on Gender.

Variable	Gender	Means Scores	sd	Degree of freedom	t-value	Significant
Learning Style	Boys	1.34	0.476	148	2.285	0.024
	Girls	1.18	0.384			

Significant at $p < 0.05$

4. Relationship between Students' Cognitive Style and their Mathematic Achievement

Table 4, showed that there was significant and positive correlation between students' cognitive style and their Mathematic achievement whereby $r = 0.477$ (moderate correlation). So, hypotheses null was rejected.

Table 4. Result of Correlation between Students' Cognitive Style and their Mathematic Achievement

Variable	r value	Significant
Students' Learning Style – Academic Means Score	0.477	0.000

Significant at $p < 0.05$

8. DISCUSSION

Result of analysis showed that large number of students 112 (74.7%) were from field-dependent compared to field-independent 28 (25.3%) cognitive styles. This study support findings by Ramlah and Md. Nasir (2007) and differ from study by Poh and Melissa Ng (2008). The finding showed that many of the students in these school especially girls were from field-dependent cognitive style. Implication of this study showed that these students need more teacher guidance and coaching in learning especially in Mathematics. Teachers must give them a lot of exercise and

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need to monitor their work everyday. If they failed to achieved 80% of the total mark, teacher should repeat the lesson until the target goal is achieved. Another way teacher can cope with the students problem is by asking excellance students to teach the poor students or organize cooperative learning. Another thing is teacher should motivate the students in learning Mathematic by giving them token-economy or gift whenever they succeed in getting good marks.

Regarding students' gender, more boys tend to have field-independent (FI) cognitive styles compared to girls which were incline to have field-dependent (FD) cognitive styles. The girls like to study in group and were easily motivated if teacher give them token-economy or gifts. Whereas boys tend to study on their own and many of them were under-achiever. So teacher still have to give them a lot of exercise and monitor their work everyday. Few school especially Chinese school, do not allow the student to go home unless they finish their exercise during school hour or the school will organize extra class for under-achiever students. By doing this, teacher will be able to help students and the students will become responsible on school exercise given by teacher. They will develop to be self-regulated such as in 'scaffolding' (Vygotsky in Santrock, 2011). In scaffolding technique, teacher play bigger role at the beginning of lesson. Teacher have to explain, give guidance and monitor every student work. But at the end of the day, when student have shown progress in understanding and doing exercise, teacher can lessen on explaining and monitoring. Gradually each student have taken responsibility on their own learning.

9. CONCLUSION

Through the study we can conclude, among the sample in the study more girls tend to have dependent- cognitive style than boys. For all teachers, they should identify their students' cognitive style. So they can prepare their lesson and teaching methods suitable to their students' preferences. Hopefully by preparing teaching that match with their students' cognitive style, the students' achievement will be higher. The teachers must also try diverse teaching style to accommodate with the students preferences.

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