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***Teachers' and Students' Thinking Styles and Their Interaction of Taiwan
Primary School***

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Background. According to Sternberg's Styles of Mental Self-government, students can learn better if their thinking styles match well with their teachers. Besides, thinking styles can be influenced by the environment. **Aims.** This study explored the relationship among teachers' thinking styles, teaching behavior, students' thinking styles, learning perception satisfaction, and achievement. **Method.** The datum were analyzed by Pearson's product-moment correlation, t-test, canonical correlation, Hotelling's T^2 , one-way MANOVA, Repeat Measure Analysis, and Multivariate Analysis of Covariance. **Results.** The direction of the result was mostly consistent with the construct of theory. **Conclusions.** The match of teachers and students' thinking styles can make students have greater learning satisfaction.

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Introduction

Instruction refers to the process in which information is imparted through teacher-student interaction. Instruction should be presented through various forms to meet students' individual differences. In the last ten years, many studies have indicated that Thinking Style is an important mediator in the course of instruction.

Sternberg (1997) holds that teachers' thinking styles lead to different teaching methods in different instruction context. In Grigorenko and Sternberg's study of 199 gifted senior high school students(1997), administered with TSQ (Thinking Style Questionnaire) and Triarchical Aptitude Test, Legislative and Judicial styles were found effective in predicting the performance of analytic tasks, and negative correlation on Executive Style; Judicial and Executive Styles were found effective in predicting the performance of creative tasks, and positive correlation on Judicial and Executive style; paper-based tests are most favorable to Judicial Style, while least favorable to Legislative/Global Style.

As pointed out by Sternberg(1994), the instructions through lectures work best for Executive and Hierarchic students, essays for Legislative and Judicial students, cooperation and group

discussion work best for External students. Sternberg further pointed out that there were no cure-all thinking styles. Whether a certain thinking style was favorable depends on the capabilities and skills stressed in the content of tests.

Besides, in teacher-student's interaction, Sternberg and Grigorenko (1995) also hold that students will seek the kind of learning activities most suitable to their thinking styles, so will teachers in teaching. In the course of instruction, the correspondence between teachers' and students' thinking styles facilitates learning. In a study of 40 elementary school teachers and 480 elementary students by Saracho (1991), the academic performance of field independent students matched with field independent teachers was found to be superior to that of field dependent students matched with field dependent teachers. Sternberg and Grigorenko (1995) indicated students' academic performances can be greatly enhanced if teachers applied various instruction and assessment approaches based on students' thinking styles and preferences.

Method

The purposes of this study were (1) to compare the relationship among teachers and students' thinking styles and their background. (2) to explore the relationship among teachers' background, teachers' thinking styles, and teaching behaviors. (3) to investigate the relationship among teaching behavior, students' thinking styles, learning perception satisfaction, and achievement. (4) to explore the influences of different matching of teachers' thinking styles and students' thinking styles on learning perception satisfaction and achievement. (5) to investigate the changing condition of students' thinking styles. (6) to explore the impact of teachers' thinking styles on students' thinking styles.

Two groups of subjects were arranged: with one including 254 primary school teachers in Kaohsiung, and the other including 14 teachers and their 507 students in Koashuing. Teachers were asked to fill out *Thinking Styles Questionnaire for Teacher (TSQT)* and *Teaching Behavior Scale (TBS)*, while students *Thinking Styles Questionnaire (TSQ)* and *Learning Perception Satisfaction Check List (LPSCCL)*. Qualitative research (Classroom observation) is applied to explore the interaction of teachers and students. The data were analyzed by Pearson's product-moment correlation, t-test, canonical correlation, Hotelling's T^2 , one-way MANOVA, Repeat Measure Analysis, and Multivariate Analysis of Covariance.

Results

Table 1

Repeat Measure Analysis of students'pre & post test of thinking styles

<i>source</i>	<i>df</i>	$F_{1-\Delta}$
thinking styles(pre & post test)	1	.02
error(pre & post test)	285	
thinking styles	6	.79***
error(thinking styles)	1710	
pre & post test * thinking styles	6	.09***
error(pre & post test*thinking)	1710	

styles)		
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*** $p < .001$.

Table 2

t test of students' pre & post test of thinking styles

thinking styles	pre test			post test			t
	N	M	SD	N	M	SD	
executive	336	24.17	5.97	336	24.65	5.87	-1.34
legislative	331	22.50	5.55	331	23.97	5.21	-4.32***
judicial	322	20.41	5.92	322	21.19	6.07	-2.07
global	331	17.43	5.18	331	17.47	5.30	-.12*
local	329	18.50	5.04	329	18.06	5.05	1.31
liberal	326	22.61	5.87	326	23.42	5.81	-2.22*
conservative	343	24.42	5.51	343	25.17	5.42	-2.09*

* $P < .05$. *** $p < .001$.

Table 3

Repeat Measure Analysis of students' pre test of thinking styles

source	df	$1-\Lambda$	post
thinking styles	6	.79***	1>2, 1>3, 1>4, 1>5, 1>6, 2>3, 2>4,
error	1710		2>5, 7>2, 3>4, 3>5, 6>3, 7>3, 5>4, 6>4, 7>4, 6>5, 7>5, 7>6

Note. thinking styles : 1 = executive ; 2 = legislative ; 3 = judicial ; 4 = global ; 5 = local ;

6 = liberal ; 7 = conservative.

*** $p < .001$.

total	28							
	4							

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 10

Correlation of thinking styles and teaching behavior

thinking styles background	legislative	executive	judicial	global	local	liberal	conservative
lecture	.43	.71	.45	.47	.58	.42	.64
memory	.34	.55	.34	.40	.48	.26	.57
creative	.68	.35	.57	.52	.41	.58	.18
inspiration	.73	.33	.59	.60	.42	.62	.17
analyze	.71	.36	.57	.56	.47	.61	.19
cooperation	.72	.33	.55	.52	.43	.58	.18
task	.69	.41	.49	.48	.49	.50	.34

unmarked: *** $p < .001$.

Table 11

Canonical Correlation Analysis of Teachers' Thinking Styles and Teaching Behavior

X variable	X_1	X_2	X_3	Y variable	η_1	η_2	η_3
legislative	-.85	-.51	-.08	lecture	-.89	.42	.08
executive	-.82	.41	.23	memory	-.71	.41	-.18
judicial	-.77	-.22	.36	creative	-.80	-.44	.16
global	-.74	-.18	.24	inspiration	-.78	-.57	.14
local	-.80	.18	-.03	analyze	-.80	-.44	.16
liberal	-.72	-.36	.39	cooperation	-.77	-.54	-.02
conservative	-.72	.56	-.21	task	-.83	-.31	-.39
percentage	.61	.14	.06	percentage	.64	.20	.03
overlap	.41	.07	.008	overlap	.43	.10	.004
				ρ^2	.67	.49	.13
				Cano. Corr.	.82	.70	.36
					$p < .001$	$P < .001$	$p < .001$

Table 12

Multivariate Analysis of Covariance of teaching behavior in students' thinking styles

teaching behavior	source	df	η^2	F						
				legislative	executive	judicial	global	local	liberal	conservative
lecture	group	2		3.24*	2.42	2.37	1.43	2.08	2.34	7.21**
	error	449	.05							
	total	451								
memory	group	2		4.11*	3.63*	1.67	1.69	3.86*	.96	1.65
	error	448	.07**							
	total	450								
creative	group	2		2.48	.44	.09	3.78*	1.61	1.81	2.53
	error	448	.07**							
	total	450								
inspiration	group	2		2.78	3.65*	2.28	.57	3.49*	1.49	1.64
	error	449	.04							
	total	451								
analyze	group	2		1.82	3.57*	1.16	.93	1.56	3.74*	1.83
	error	449	.04							
	total	451								
cooperation	group	2		1.19	.88	3.22*	.21	3.28*	.78	4.25*
	error	449	.05							
	total	451								
task	group	2		4.66**	8.45***	2.97	.20	1.43	3.97*	1.60
	error	449	.07**							
	total	451								

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 13

Posteriori Comparisons of memory teaching in students' thinking styles

thinking styles	group	<i>N</i>	<i>M</i>	<i>SD</i>	<i>F</i>	post
executive	high	143	24.28	6.19	4.11*	3>2
	mid	163	23.98	5.39		
	low	145	25.66	5.75		
legislative	high	143	22.93	5.78	3.63*	3>1
	mid	163	23.89	5.06		
	low	145	24.77	5.56		
local	high	143	17.78	5.10	3.86*	3>2
	mid	163	17.23	4.78		
	low	145	18.78	4.88		

Note.memory teaching : 1for high; 2 for mid; 3 for low.

* $p < .05$.

Table 14

Posteriori Comparisons of creative teaching in students' thinking styles

thinking styles	group	<i>N</i>	<i>M</i>	<i>SD</i>	<i>F</i>	post
global	high	156	16.57	5.04	3.78*	2>1
	mid	183	17.96	5.09		
	low	112	16.69	5.22		

Note.creative teaching : 1for high; 2 for mid; 3 for low.

* $p < .05$.

Table 15

Posteriori Comparisons of task teaching in students' thinking styles

thinking styles	group	N	M	SD	F	post
executive	high	193	25.46	5.62	8.45***	1>2
	mid	119	22.80	5.29		3>2
	low	140	24.99	6.14		
legislative	high	193	24.53	4.95	4.66**	1>2
	mid	119	22.61	5.40		
	low	140	24.00	6.10		
liberal	high	193	24.06	5.45	3.97*	1>2
	mid	119	22.24	5.88		
	low	140	23.87	6.29		

Note.task teaching: 1for high; 2 for mid; 3 for low.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 16

Multivariate Analysis of Covariance of teaching behavior in students' learning perception satisfaction and achievement

teaching behavior	source	df	$1-\Delta$	F	
				satisfaction	achievement
lecture	group	2		1.23	.1
	error	396	.01		
	total	398			
memory	group	2		2.27	.49
	error	396	.01		
	total	398			
creative	group	2		5.12**	.51
	error	396	.03*		
	total	398			
inspiration	group	2		9.81***	.27
	error	396	.05***		
	total	398			
analyze	group	2		8.86***	.15
	error	396	.04**		

	total	398			
cooperation	group	2		3.1*	.15
	error	396	.02		
	total	398			
task	group	2	.04**	8.60***	.05
	error	396			
	total	398			

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 17

Posteriori Comparisons of teaching behavior in students' learning perception satisfaction

teaching behavior	group	N	M	SD	F	post
creative	high	160	50.64	15.80	5.12**	3>1
	mid	142	53.22	15.52		
	low	97	56.95	14.17		
inspiration	high	179	53.53	15.45	9.81***	3>1
	mid	153	49.73	15.17		
	low	68	59.43	14.13		
analyze	high	155	54.14	14.69	8.86***	1>2
	mid	149	49.26	15.80		
	low	96	57.31	14.90		
task	high	181	53.93	15.60	8.60***	1>2
	mid	58	45.52	12.83		
	low	160	54.88	15.49		

Note. teaching behavior : 1 for high ; 2 for mid ; 3 for low.

** $p < .01$. *** $p < .001$.

Table 18

Multivariate Analysis of Covariance of achievement in students' thinking styles

source	Df	$1-\Lambda$	F						
			legislative	executive	judicial	global	local	liberal	conservative
group	2	.1***	3.44*	9.75***	1.40	3.31*	.29	7.88***	5.20**
error	397								
total	399								

Note.achievement : 1for high ;2 for mid ; 3 for low.

* $p < .05$.

Table 19

Posteriori Comparisons of achievement in students' learning styles

thinking styles	group	N	M	SD	F	post
legislative	high	128	24.56	5.28	3.44*	1>3
	mid	163	24.10	5.45		
	low	109	22.75	5.73		
executive	high	128	25.63	5.92	9.75***	1>3
	mid	163	25.03	5.59		
	low	109	22.47	6.02		
global	high	128	16.41	5.25	3.31*	3>1
	mid	163	17.20	4.97		
	low	109	18.14	5.25		
liberal	high	128	24.22	5.81	7.88***	1>3
	mid	163	24.36	5.36		
	low	109	21.72	6.31		
conservative	high	128	25.91	5.47	5.20**	1>3
	mid	163	25.48	5.29		
	low	109	23.77	5.34		

Note.achievement : 1for high ; 2 for mid ; 3 for low.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 20

Multivariate Analysis of Covariance of match of teachers-students' thinking styles in students' learning perception satisfaction and achievement

thinking styles	source	df	Hotelling's T^2	F	
				satisfaction	achievement
legislative	group	1		4.64*	1.35
	error	395	55.3		
	total	396			
executive	group	1		29.09***	.978
	error	393	294.75***		
	total	394			
judicial	group	1	58.8	5.722*	.01
	error	392			
	total	393			
global	group	1		.20	2.69
	error	395	31.6		
	total	396			
local	group	1		7.08**	4.76*
	error	396	130.68**		
	total	397			
liberal	group	1		16.18***	.03
	error	397	162.77***		
	total	398			
conservative	group	1		1.10	.20
	error	395	11.85		
	total	396			

* $p < .05$. *** $p < .001$.

Table 21

Posteriori Comparisons of match of teachers-students' thinking styles in students' learning perception satisfaction

thinking styles	group	N	M	SD	F	post
executive	match	25	59.48	17.06	29.09***	match>mismatch
	mismatch	372	52.63	15.28		
local	match	44	58.89	14.86	7.08**	match>mismatch
	mismatch	354	52.35	15.42		
liberal	match	52	60.94	13.05	16.18***	match>mismatch
	mismatch	347	51.86	15.46		

* $p < .05$. ** $p < .01$. *** $p < .001$.

Conclusion

The conclusion were drawn as follows:

Students' thinking styles are more inclined to legislative, global, liberal, and conservative styles in pre-test than in post-test.

Teachers' background had no canonical correlation with teachers' thinking styles. Teachers' thinking styles had canonical correlation with teaching behavior. Three canonical factors of Teachers' thinking styles efficacy explained 53.4% of all teacher behavior.

Teachers' legislative, executive, and liberal thinking styles had significant effects on students' thinking styles.

Some teaching behavior had significant correlation with students' thinking styles.

Teaching behavior had significant correlation with learning perception satisfaction, but not achievement.

Teachers' thinking styles had significant correlation with students' thinking styles.

Matching of teacher-student's thinking styles had significant correlation with learning perception satisfaction and achievement.

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