

BRAIN DOMINANCE AND REFLECTIVE THINKING OF STUDENT TEACHERS ACROSS EDUCATION INSTITUTIONS

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Abstract

The primary objective of this study was to investigate the student teachers' reflective thinking skill. In addition, to examine the brain dominance was of next interest. Design of this study would be cross-sectional in nature. This study conducted across Education Institutions in Myanmar. A total of 1004 student teachers from two Universities of Education and five Education Degree Colleges participated in this study. Brain Dominance Test (Hough, 2010), and Reflective Thinking Questionnaire (Kember et al., 2000) were used as the research instruments. Brain Dominance Test is composed of 50 questionnaires. Reflective Thinking Scale is composed of 16 items. It consists of four subscales such as habitual action, understanding, reflection and critical reflection. Brain Dominance Test and Reflective Thinking Scale coded by using five point Likert type scale, with 1=definitely disagree to 5=definitely agree. The results stated that 343(34%) of student teachers were found to be whole brain thinkers, and 532(53%) were definitely left brain thinkers and the rest 129(13%) were definitely right brain thinkers. Among 1004 participants, the majority of student teachers have average level of reflective thinking skill. Specifically, it can be said that first year student teachers have higher level of reflective thinking than second year student teachers. Most of the definitely left-brain thinkers are in high level of reflective thinking group. Results indicated that there is a significant main effect of type of brain dominance on the reflective thinking of student teachers. Besides, reflective thinking of student teachers can differ depending on their gender and education level.

Keywords: Brain Dominance, Reflective Thinking, Student Teachers

Introduction

The adult human brain is a wet, fragile mass that weights a little over three pounds. It is about the size of a small grapefruit, it shaped like a walnut, and can fit in palm of your hand. Cradled in the skull and surrounded by protective membranes, it is poised at the top of the spinal column. The brain works ceaselessly, even when we are asleep. Although it represents only about 2 percent of our body weight, it consumes nearly 20 percent of our calories! The more we think, the more calories we burn. Perhaps this can be a new diet fad, and we could modify Descartes' famous quotation from "I think, therefore I'm thin"! (Sousa, 2006).

According to Khin Zaw (2001), man or homo sapiens as he somewhat arrogantly calls himself, in respect to his body and physiological functions, belongs to the animal kingdom. The brain of an animal is very far from being on a par with human counterpart. The human brain has long been regarded with wonder and awe. Unique among the animals, he has used his mind to reason; to count and speak. Brain scientists and psychologists must remember that the two brains are simply worlds apart in difference, not only in size and /or weight, but in qualitative biological organization. They also differ in performance functions. The higher an animal is in the scale of development, the more flexibility of action pattern and the less completeness of structural adjustment do we find at birth (Khin Zaw, 2001).

According to LoCicero (2005), on the thinking front, the brain's interconnected cells allow people to speak, describe, argue, create, articulate, organize, decide and dream. Anatomically speaking, the brain is split into two halves or more technically hemispheres. These halves are commonly called the right brain and left brain, but should more correctly be termed "hemispheres". These halves are separated by a deep groove called the corpus callosum. The corpus callosum is a thick band of fibers bridging the right and left hemispheres of the brain, allowing the two sides to communicate with each other. This bridge keeps the two halves in

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touch, swapping information back and forth. Fortunately, that connection keeps the left and right brains working in concert. Each hemisphere seems it should be completely identical to each other, but they're not really. The left side of the brain actually controls the action of right side of the body and vice versa. The nerves from each side cross over at the top of the spinal cord. The whole concept of right and left brain thinking was borne out of research conducted by American Nobel Prize Winner Roger Wolcott Sperry (LoCicero, 2005). Brain dominance is the idea that people use different sides of their brains to process different kinds of information. People use both sides of their brain, but most individuals tend to prefer thinking strategies associated with one side or the other. Such individuals are considered to be left-brain thinkers or right-brain thinkers. In most people, the left side seems to be the "words" side, controlling speech, understanding language, and reasoning things out. It can also be attributed such logical tasks as language and math to that side. On other hand, the right side seems to be the "picture" side, specializing in visual task, giving a sense of where things are, and responding to intuition. The right brain also is touted as the "emotional" one, responding to sensory perception, faces, and music. In addition, the left brain uses linear, sequential, symbolic, logical, verbal, and reality-based thinking, the right brain works with holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented approaches (LoCicero, 2005).

In general, the left and right hemispheres of the brain process information in different ways. However, the learning and thinking process is enhanced when both sides of the brain participate in a balanced manner (Wagner, 2009). Recent research has shown that abilities in subjects such as math are actually strongest when both halves of the brain work together. According to Shephard (2001), neuroscience has provided a number of valuable insights into the cognitive or thinking activities of the brain. It has documented that the most successful people and high-performance teams use their "whole brain". Thus, learning to use whole brain for thinking, and learning, will make more effective.

Gibson (2002) proposed that every individuals use different sides of their brains to process different kinds of information because the dominance of their brain causes certain effects on their learning and communication. Each hemisphere of the brain is in charge of the variations in teaching methods in the classroom (Connell, 2005). Thus, teachers who are right-brained tend to use mainly right-brain teaching methods and the left-brained teachers use left-brain teaching methods (Connell, 2005). Hence, teachers' awareness of their brain dominance is an important issue that can help them to adjust their teaching method to students' brain dominance (as cited in Nu Nu Nyunt, 2010).

Many researchers have implied that reflective thinking has a similar nature to reflection, the reflective process, and reflective practice (Burbank, Ramirez & Bates, 2012; Osterman, 1990) (as cited in Choy, 2017). Reflection is the concept on the basis of reflective thinking. Reflection, the most general sense, is the cognitive inquiry process that contains analyzing and finding ways which will lead to production of new knowledge and experiences in the context of previous knowledge and development of alternative ways (as cited in Sunbul, 2012).

In the early 20th century, J. Dewey proposed an approach that all people learn from their experiences in education and stated that life itself was training and development, and the real purpose of education was to make development explicit. He also indicated that the most important need of the society was students' learning to reflect to life what they have learned at school. Dewey defines the reflective thinking as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends" (as cited in Mahasneh, 2013).

Improvement of teaching may be achieved through „reflection". Richard (1990) defines reflections a key component of teacher development. Paradigm of reflective teaching prevails in teacher education or training all over the world. Teachers use reflective teaching strategies to

improve their teaching quality (Bolton, 2010). Indeed, reflection is a purposeful activity that needs critical thinking and looks for solutions about the problems occurred during teaching and learning process (Loughran, 2005). So, the student teachers need to have a well knowledge of reflective thinking and use reflective teaching strategies to become the qualified teachers in future (as cited in Ashraf, 2017).

Teachers should help student teachers by promoting students' thinking skills rather than rote memorization of facts. In this regard, thinking reflectively is an important and necessary outcome of education. If student teachers have a chance to learn to think reflectively in the school, they will become truly educated person. So, it is the right time for the education in Myanmar to be aware of the need to inculcate the habit of reflective thinking in every academic discipline and at every level of education.

Although several thinking studies have been conducted in previous years throughout the world, research related to reflective thinking and brain dominance was rare, especially in the field of teacher education and teacher training in Myanmar. To fulfill this need, current study will seek to identify and explain reflective thinking and brain dominance of selected student teachers in the contexts of teacher education. Therefore, this study tried to explore the student teachers' reflective thinking skill and brain dominance with respect to learning environment in Myanmar context.

Aim and Objectives

The aim of this study is to investigate the student teachers' reflective thinking. And then, to examine their brain dominance is the next of interest. Finally this study explores the interrelationship between the student teachers' reflective thinking and brain dominance. The specific objectives of this research are-

1. To investigate the brain dominance of student teachers by gender, education institutions, and education level.
2. To examine the reflective thinking of student teachers by gender, education institutions, and education level.
3. To find out whether there is interaction effect among brain dominance and other independent variables on student teachers' reflective thinking.

Definition of Key Terms

Brain Dominance: Brain dominance is the idea that people use different sides of their brains to process different kinds of information (Nu Nu Nyunt, 2010).

Reflective Thinking: According to Dewey (1993), reflective thinking is defined as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends" (as cited in Mahasneh, 2013).

Student Teachers: A student teacher is a college, university or graduate student who is teaching under the supervision of a certified teacher in order to qualify for a degree in education (Bonadea, 2017).

Method

Research Design

The design used in this study was quantitative research design. Descriptive survey method was utilized in the present study.

Sampling

By using random sampling technique, the student teachers were selected from 7 Education Institutions in Myanmar. The number of the students administered by Education Institutions was mentioned in Table 1.

Table 1. Distribution of Student Teachers from 7 Education Institutions in Terms of Gender

No		Numbers of Participants				Total
		1 st Year		2 nd Year		
		Male	Female	Male	Female	
1.	Yangon University of Education	40	40	40	40	160
2.	Sagaing University of Education	40	40	40	40	160
3.	Hlegu Education College	40	40	40	40	160
4.	Mawlamyine Education College	40	40	40	40	160
5.	Taungoo Education College	40	40	40	40	160
6.	Monywa Education College	40	40	40	40	160
7.	Kyaukphyu Education College	40	40	40	40	160
		280	280	280	280	1120

Instrumentation

Brain dominance test is also a five-point Likert scale with 1 = never, 2 = sometimes, 3 = often, 4 = usually and 5 = always. A total of 50 items Questionnaire for Brain Dominance developed by Hough (2010), was used to investigate student teachers' type of Brain Dominance. The internal consistency (Cronbach's Alpha) for this questionnaire was 0.807. Among 50 items, 25 items stand for left-brain and other 25 items stand for right brain preference. Add the scores for each item to reach total score of each hemisphere. After that, subtract total score from greater total score of particular hemispheres either left or right to find the degree to which an individual tends to favour whether the left brain over the right brain or the right brain over the left brain.

Reflective thinking questionnaire was developed by Kember et.al (2000). There are four subscales in this questionnaire: habitual action, understanding, reflection and critical reflection. It is also a five-point Likert Scale where responses categories are definitely disagree, disagree with reservation, only to be used if a definite answer is not possible, agree only with reservation, and definitely agree, the scoring of these categories is 1,2,3,4, and 5, respectively. The internal consistency (Cronbach's Alpha) for this questionnaire was 0.660. The scores were added to differ the levels of reflective thinking of student teachers. The scores of under 59 was low level, the scores between 60 and 67 were designated as average level and student teachers who had scores above 68 were high level of reflective thinking.

Table 2. Distribution and Percentages of Student Teachers

	Whole Brain		Left Brain		Right Brain	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Student Teachers	343	34%	532	53%	129	13%

In Table (3), it can be said that most of the male student teachers are left brain dominance and most of the female are right brain dominance. The proportion of whole brain dominance both the sex is almost equal.

Table 3. Brain Dominance of Student Teachers by Gender

	Whole Brain		Moderately Left Brain		Definitely Left Brain		Moderately Right Brain		Definitely Right Brain		Chi-Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
Male	163	33%	169	34%	110	22%	43	9%	6	2%	10.172*	0.038
Female	180	35%	158	31%	95	18%	65	13%	15	3%		

*The mean difference is significant at 0.05 level.

A chi-square test was conducted to address the research question of the relationship between the participants' brain dominance and gender. The results showed a significant difference $X^2(4, N=1004) = 10.172, p=0.038$. It can be interpreted that there is a relationship between the participants' brain dominance and gender. This finding was consistent with previous brain research. According to Gomathi (2017), there is a significant difference between brain dominance and gender.

In Table 4, student teachers from Education Degree Colleges have more use of whole brain than Education Universities.

Table 4. Brain Dominance of Student Teachers by Education Institutions

	Whole Brain		Moderately Left Brain		Definitely Left Brain		Moderately Right Brain		Definitely Right Brain		Chi-Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
YUOE	36	29%	42	34%	33	27%	11	9%	1	1%	44.795**	0.006
SUOE	40	30%	47	36%	34	26%	10	8%	0	0%		
TEC	64	39%	54	33%	34	21%	11	6%	1	1%		
HEC	58	36%	48	30%	19	12%	28	18%	6	4%		
MEC	39	30%	44	34%	20	15%	22	17%	5	4%		
MoEC	50	36%	43	31%	33	24%	10	7%	3	2%		
KEC	56	36%	49	31%	32	20%	16	10%	5	3%		

**The mean difference is significant at 0.01 level.

A chi-square test was conducted to address the research question of the relationship between the participants' brain dominance and education institutions. The results showed a significant difference $X^2(24, N=1004) = 44.795, p=0.006$. It can be interpreted that there is a significant relationship between the participants' brain dominance and education institutions.

Based on these findings, teacher educators from these institutions should be aware to make sure their course meet the need of their students and engage both left and right brain

functions. Besides, they should emphasize the co-curriculum course to have an equal balance of students' brain functions.

In Table 5, it can be said that the second year student teachers were more than the first year student teachers in the whole brain and right brain mode. But, in the type of left brain dominance, the percentage of first year student teachers was more than the second year student teachers.

Table 5. Brain Dominance of Student Teachers by Education Level

	Whole Brain		Moderately Left Brain		Definitely Left Brain		Moderately Right Brain		Definitely Right Brain		Chi-Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
1st Yr	165	33%	170	33%	112	22%	50	10%	9	2%	3.728	0.444
2 nd Yr	178	36%	157	31%	93	19%	58	12%	12	2%		

In Table 6, majority of the participants generally provided responses that displayed average level of reflective thinking skills. Most of the male student teachers are low level of reflective thinkers and most of the female are high level of reflective thinkers. In the average level of reflective thinking, the percentages the female get are more than the male.

Table 6. Chi-square Analysis of Reflective Thinking and Gender

Student Teachers	Low		Average		High		Chi Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
Male	217	44%	195	40%	79	16%	17.041***	0.000
Female	162	32%	247	48%	104	20%		

***The mean difference is significant at 0.001 level.

Chi-square test was conducted to address the research question of the relationship between the participants' reflective thinking and gender. The results showed a statistical significant difference $\chi^2(2, N=1004) = 17.041, p=0.000$. It can be concluded that a number of girls who belongs high and average reflective thinking skills are more than the boys in his study. In other words, girls are better at reflective thinking skills.

In Table 7, chi-square test was conducted to address the research question of the relationship between the participants' reflective thinking and education institutions. The results showed no statistical significant difference $\chi^2(12, N=1004) = 16.460, p=0.171$. It can be interpreted that there is no significant difference between the participants' reflective thinking from these education institutions. In other words, the level of reflective thinking doesn't depend on the different types of education institutions.

Table 7. Chi-square Analysis of Reflective Thinking and Education Institutions

	Low		Average		High		Chi Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
YUOE	43	35%	58	47%	22	18%	16.460	0.171
SUOE	53	40%	59	45%	19	15%		
TEC	52	32%	81	49%	31	19%		
HEC	61	38%	62	39%	36	23%		

	Low		Average		High		Chi Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
MEC	62	48%	42	32%	26	20%		
MoEC	49	35%	68	49%	22	16%		
KEC	59	37%	72	46%	27	17%		

In Table 8, results evidently showed that first year student teachers have the more percentages of high level of reflective thinking than second year student teachers. Conversely, results also showed that first year student teachers have less percentages of low level of reflective thinking than second year student teachers. The proportion of average level of reflective thinking skill both the first and second year is almost equal.

Table 8. Chi-square Analysis of Reflective Thinking and Education Level

	Low		Average		High		Chi Square	<i>p</i>
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
First Year	169	33%	228	45%	109	22%	11.510**	0.003
Second Year	210	42%	214	43%	74	15%		

**The mean difference is significant at 0.01 level.

A chi-square test was conducted to address the research question of the relationship between the participants' reflective thinking and education level. The results showed a statistical significant difference $\chi^2(2, N=1004) = 11.510, p=0.003$. It can be interpreted that there is association between the participants' reflective thinking and education level.

In other words, it can be said that first year student teachers have high level of reflective thinking. The reason is that teacher educators who teach first year student teachers altered their teaching styles and classroom settings to promote their student teachers' level of reflective thinking in accordance with the modified new curriculum.

In Table 9, concerning brain dominance and reflective thinking, results indicated that there is a significant main effect of type of brain dominance on the reflective thinking of student teachers.

Table 9. Interaction Effect of Brain Dominance on Reflective Thinking

Source	df	<i>F</i>	<i>p</i>	Partial Eta Squared
Type of Brain Dominance	4	12.183***	0.000	0.047

*** The mean difference is significant at 0.001 level.

The two-way analysis of variance was conducted to investigate reflective thinking differences in the type of brain dominance among student teachers. ANOVA results showed a significant main effect for the type of brain dominance $F(4,999) = 12.183, p < .001$, partial eta squared = .047. The Bonferroni post hoc test was conducted to determine which types of brain dominance were significantly different. Results revealed that the definitely left-brain dominance significantly differed in reflective thinking from all other types of brain dominance.

Table 10. Post Hoc Test Analysis of Reflective Thinking by Brain Dominance

(I) Type of Brain Dominance	(J) Type of Brain Dominance	Mean Difference (I-J)	Std. Error	<i>p</i>
definitely left	whole Brain	3.57***	0.632	0.000
	moderately left	2.50**	0.638	0.001
	moderately right	4.65***	0.852	0.000
	definitely right	6.61**	1.641	0.001

**The mean difference is significant at 0.01 level.

*** The mean difference is significant at 0.001 level.

In Table 11, concerning other independent variables and reflective thinking, results indicated that there is a significant main effect of gender and education level on the reflective thinking of student teachers.

Table 11. Interaction Effect of other Independent Variables on Reflective Thinking

Source	df	<i>F</i>	<i>p</i>	Partial Eta Squared
Gender	1	19.300***	.000	0.019
Education Level	1	9.867**	.002	0.010

** The mean difference is significant at 0.01 level.

*** The mean difference is significant at 0.001 level.

The two-way analysis of variance was conducted to investigate reflective thinking differences in gender and education level. ANOVA results show a significant main effect for gender $F(1,989) = 19.300$, $p < .001$, partial eta squared = .019 and for education level $F(1,989) = 9.867$, $p < .01$, partial eta squared = .010. Post hoc tests on gender and education level are not necessary because these variables have only two categories. Results revealed that reflective thinking of student teachers significantly differed depending on gender and education level. Concerning gender, a number of girls who belongs high and average reflective thinking skills are more than the boys in his study. In other words, girls are better at reflective thinking skills. By education level, first year student teachers have the more percentages of high and average level of reflective thinking than second year student teachers.

Discussion

Concerning brain dominance, majority of the student teachers (53%) from the sample were left brain thinkers. Education Colleges possess the more percentage of whole brain learners. Concerning reflective thinking, most of the female and first year student teachers possess more percentages of high and average level of reflective thinking. The reason is that teacher educators who teach first year student teachers change their teaching styles with the modified new curriculum and classroom settings. It promotes their student teachers' level of reflective thinking. The type of brain dominance makes an impact on the reflective thinking of student teachers. Besides, reflective thinking of student teachers can differ depending on their gender and education level.

As a result, this study indicates that student teachers tend to identify left brain characteristics as dominant traits in their colleges. Although right brain characteristics are generally present, the student teachers felt them to be stressed less frequently than the left counterparts. Education in Myanmar may be geared more to left brain functions than to right

brain ones. Educators need to reevaluate the content and methodology to more equally balance the scope of learning-in short, to educate the whole brain. Just as we need to use both legs to walk effectively, we need to use both hemispheres to respond to life in a balanced fashion (Acosta, 2012). Teachers should design lessons that include activities directed at both hemispheres so that students can integrate the new learning into a meaningful whole (Sousa, 2006). There are some ways to do that in daily planning

- (1) Deal with Concepts Verbally Visually
- (2) Design Effective Visual Aids.
- (3) Discuss Concepts Logically and Intuitively.
- (4) Avoid Conflicting Message
- (5) Design Activities and Assessments for Both Hemispheres.

Moreover, to improve the reflective thinking, student teachers should have opportunities to train with the above activities and approaches of the modified new curriculum. Based on the literature review and the findings of this study, there are implications within the design and development of courses to meet the learners' needs. Hence, it is important for teachers, instructors, adult educators, trainers, course designers, program and training developers to be aware of the individual learners' need and design course and training curriculum. Adult educators, teachers and instructors could change the way they design the courses by including certain specific activities to accommodate different learning styles of the student teachers to achieve course goals and to make sure that expected learning occurs. Students can enhance their learning using their most preferred or stronger learning styles and make an effort to enhance their weaker learning styles to make their learning experience more exciting for themselves.

Conclusion

Based on these findings, teacher educators from education institutions should be aware to make sure their teaching techniques to meet the skills of 21st century skill; critical thinking, creativity, collaboration and communication. Besides, they should emphasize the co- curriculum course and activities to have an equal balance of students' brain functions for thinking and learning. Teacher Educators should well implement teaching styles and classroom settings in accordance with the modified new curriculum to improve the reflective thinking skills of student teachers.

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