Learning Style (Brain Dominance) on STEM Student Achievement

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Abstract—This research was a quantitative research design in this study, the researcher limited discussion by stating the following research problem: "Is there any relationship between learning style on STEM students Achievement?". "Does the learning style affect their achievement?". This study aimed to find out the most dominance used by students in learning STEM and to find out whether or not an effect between right-brain and left-brain on STEM learning. The result of this study can help teachers' methods in teaching-learning. The subject of this study was the STEM students of university level. The sample of this research was 45 students. The data were collected using interview STEM education, questionnaire 5-Likert scale, and test. The data were analyzed using an independent t-test through SPSS 22.0 version. The result of this research showed that the finding effect between right-brain and left-brain dominance on learning achievement is positive result means that there is a difference between right-brain and left-brain dominance on their achievement. The level sig. (2 tailed) was greater than the level of significance (.00 < 0.05), then H0 was rejected H1 was accepted. It can be said that all students of the STEM Education Department use left-brain dominance in the learning process. Meaning that the students who use right-brain dominance have good scores and students who lowest score also use right-brain dominance but it is not suitable for them. These findings imply that students who learn analytical with left-brain dominance will be good in achievement than those who learn with the other brain dominance. The researcher suggested applying the brain dominance provided to overcome their difficulties. However, this research was expected to be developed by future researchers who had the same interest.

Keywords— STEM Education, Learning Style, Achievement

I. INTRODUCTION

In this world, there are various subjects, one of them is STEM (Science, Technology, Engineering, Mathematics) education. STEM combines four subjects: science, technology, engineering, and mathematics. STEM education not only serves as a tool in our lives, but it also represents inquiry and practice. It must be learned because we not only learn but also practice in this subject.As a result, most people believe STEM education has a positive impact and readily assume that STEM integrated education influences instructors' instructional tactics as well as students' attitudes and academic achievement. Because of their belief in the power of STEM education, classroom teachers are being urged to incorporate STEM education into their curriculum.

There is some problem in learning process one of them is learning style. Some teacher does not aware with their students learning style. They only focus to the material as the result the students with different learning style difficult to understand the material. Learning style can be helpful and beneficial to the student in becoming more focused on an attentive student that will increase learning process. Discovering the learning style will allow the student to determine their own personal strengths and weaknesses and learn from them. Teachers can incorporate learning styles into their classroom by identifying the learning styles of each student, matching teaching style to learning style for difficult tasks, strengthening weaker learning styles through easier tasks and drill, teaching students, and learning style selection Kartika et al., (2014). Another benefit it will help the learners to be a problem solver because the learners can control and solve problem that they faced while learning process. Identifying students learning styles also provides information why each student has different learning styles. Every student has different learning style by identifying students' learning style, the teachers can organize classroom based on their individual needs. As a result, teachers must learn about the learning and cognitive preferences that students bring to class and incorporate those preferences into their instruction. As a result, students' learning experiences will be enhanced, and they will learn language aspects in the way that best suits their learning preferences. Brain hemisphericity, or brain specialization, has piqued the interest of some researchers among the learning styles.

Left brain dominance refers to how students learn or think about material using their left brain. They may be unaware that she or he is constantly using their left brain. Students who are left brain dominated are usually easy to understand when it comes to grammar and structure. According to Singh (2015), intellectual, remember names, verbal response to instructions and explanations, experiments systematically and with control, makes

objective judgments, planned and structured, prefers established certain information, analytic reader, reliance on language in thinking and remembering, prefers talking and writing, prefer multiple choice test, control feelings, not good at interpreting body language, rarely used.

Right brain dominance refers to how students learn or think about material using their right brain. This type of brain is known as a challenging brain. Students who prefer writing are classified as right brain dominated. As a result, they prefer essay questions to multiple-choice questions. According to Singh (2015), right brain dominated students are intuitive, remember faces, respond to demonstrated, illustrated, or symbolic instruction, experiment randomly or with less restraint, make subjective judgments, fluid and spontaneous, prefer elusive, uncertain information, synthesizing reader, reliance on imaging in thinking and remembering, prefer drawing and manipulating objects, prefer open ended (essay) questions, and are freer.

For the reasons stated above, the researcher has a strong reason to conduct the study "Learning Style (Brain Dominance) on STEM Students Achievement."

II. METHODS

A. Research Design

This study is quantitative and the research design is Ex-Post Facto design. According to Latief (2016) the relationship between two variables which do not manipulate the independent variable is Ex-Post Facto. It is known that this design does not give treatment to independent variable. The dependent variable of this research is academic achievement in learning STEM and independent variables are the students 'left brain and right brain dominance.Samples is the part of the population of study. The samples of this study were 40 students that have same grade in Junior High School in Indonesia. Researcher use simple random sampling to get the participant.

B. Collecting the data

The data collected in this study were in form of questionnaire that adapted from Brown (2000) and achievement test. The procedure of collecting data was divided into several steps. The first step was choosing the participants. The researcher administered the simple random sampling technique to get the sample. The next step was the questionnaire distribution. The researcher distributed the questionnaire to the participants and respondents were given time 30 minutes to finish the questionnaire. In this step the researcher collected the information about dominance of the left-brain and right-brain.

This questionnaire has two scoring directions: the first is ascending for numbers 1, 2, 5, 6, 8, 10, 11, 14, 15, 19, and 20. Second, the scoring direction for numbers 3, 4, 7, 9, 12, 13, 16, 17, and 18 is descending. The total score is used to categorize students as left brain dominated, right brain dominated, or no brain dominated. The score stars below 57 are classified as left brain dominated. If the score ranges from 57 to 66, it indicates that there is no brain dominance. A score of 66 or higher indicates that the right brain is dominant.

The second set of data was obtained through testing. The test was used to ensure that student achievement has improved. In this case, the researcher used a reading test with 20 items that included multiple choice (10 items) and essay questions (10 Items). The author used the same test for two groups (left and right) to determine whether students who learned using the right brain outperformed students who learned using the left brain in reading achievement. Each item on the test has the same score, so the total score is 100 for multiple choice item 5 and essay item 5.

Following the collection of all data, the researchers analyzed it using descriptive statistical procedures or the Statistical Package for the Social Sciences (SPSS), as well as the independent t-test. This application is designed to determine whether left brain dominated students perform significantly better in answering multiple choice tests of reading two than right brain dominated students, and whether right brain dominated students perform significantly better in answering essay tests of reading two than left brain dominated students. The first step was for the researcher to categorize the group statistic in SPSS v22 as left or right brain. The researcher then entered the reading test score into SPSS. Finally, to determine the result, researchers compared the means and analyzed the data using an independent sample t-test.

III. RESULTS AND DISCUSSION

In what follows, firstly various statistical calculations are presented followed by the discussion as a separate section.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
								95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Test Achievement	Equal variances assumed	5 ,546	, 027	-2 5,363	4	, 000	- 19,154	3,5 71	- 26,525	- 11,783
	Equal variances not assumed			-7, 5,363	8 9 9	, 000	- 19,154	3,5 71	- 26,660	- 11,648

The results of Learning Style on Academic Achievement in STEM Students, tests support the above findings as non-normality of the data on multipel choice and essay. All the statistics have significance values less than .05.

Group Statistics

	learning_styles	N	Mean	Std. Deviation	Std. Error Mean
Test Achviement	left brain	13	65, 85	11,459	3,178
	right brain	13	85, 00	5,874	1,629

What is the relationship between the brain dominance and academic achievement STEM student?

Results obtained from the normality test indicated that the tests are needed here; so, two- independent samples test was run to investigate any significance between the brain dominance and academic achievement at STEM student. The statistic was 5,546, which was a significant one (P = .027 < .05). According to the mentioned results, it might be concluded that there is any significant relationship between the brain dominance and academic achievement at STEM student. Therefore, the answer to the question is that there is any significant relationship between the brain dominance and academic achievement at STEM student. Meanwhile, the means for the left-brain students is 65,85 and for the right-brain is 85.00 which verify the support of question answered.

IV. CONCLUSION

It can be concluded that the students have different learning style are related with the dominance of right or left brain. This has a great impact during the learning process. Therefore, they having an idea about the brain dominance of the students is important. If the teacher knows his or her students well, he or she can use the methods, techniques and material suitable. This research will provide the teachers to find out the dominant part of their students' brains and use the appropriate classroom, methods and tools according to them. It will also give the opportunity of finding out the teachers' brain dominance to help him/her to be aware of his/her teaching style. For the next researcher I suggest try to investigate by using another instrument/design like classroom observation or interviewing the participants so you will get deeper result.

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Attachment 1

Learning style questionnaire

In this test, each item has two contrasting statements. Between the two statements is a scale of five points on which you are to indicate your perception of which statement best describes you. Boxes 1 and 5 indicate that a statement is very much like you; boxes 2 and 4 indicate that one statement is somewhat more like you than other statement; box 3 indicate no particular learning one way or the other.

I prefer speaking to large audiances	1	2	3	4	5	I prefer speaking in small group situations

Box number 4 has been checked to indicate a moderate preference for speaking is small group situations.

1. I remember names	1	2	3	4	5	1. I remember faces

1. I respond better to verbal instructions.	1	2	3	4	5	1. I respond better to demonstrated, illustrated, symbolic, instruction

1. I am intuitive	1	2	3	4	5	1. I am intellectual

1. I experiment randomly and with little restraint	1	2	3	4	5	1. I experiment systematically and with control

1. I prefer solving a problem by breaking it down into parts, then approaching the problem sequentially, using logic.	1	2	3	4	5	1. I prefer solving problem by looking at the whole, the configurations, then approaching the problem through patterns, using hunches

1. I make objective judgments, extrinsic to person.	1	2	3	4	5	1. I make subjective judgments, intrinsic to person

1. I am fluid and spontaneous.	1	2	3	4	5	1. I am planned and structured

1. I prefer established, certain information	1	2	3	4	5	1. I prefer elusive, uncertain information

1. I am synthesizing reader	1	2	3	4	5	1. I am an analytical reader

1. I rely primarily on language thinking and remembering	1	2	3	4	5	1. I rely primarily on images in thinking and remembering.

1. I prefer talking and writing	1	2	3	4	5	1. I prefer drawing and manipulating objects.

1. I am easily distracted when trying to read in noisy or crowded places.	1	2	3	4	5	1. I am an analytical reader

1. I prefer work and/or studies that are open-ended.	1	2	3	4	5	1. I prefer work and/or studies that are carefully planned

1. I prefer hierarchical (ranked) authority structures	1	2	3	4	5	1. I prefer collegial (participative) authority structure

1. I control my feelings.	1	2	3	4	5	1. I am more free with my feelings.

1. I respond best to kinetic stimuli (movement, action).	1	2	3	4	5	1. I respond best to audiotory, visual stimuli

1. I am good at interpreting body language	1	2	3	4	5	1. I am good at paying attention to people' exact word

1. I frequently use metaphors and analogies	1	2	3	4	5	1. I rarely use metaphors or analogies

1. I favor logical problem solving	1	2	3	4	5	1. I favor intuitive problem solving

1. I prefer multiple-choice test	1	2	3	4	5	1. I prefer open-ended questions

Attachment 2

Test : https://drmoku.com/stem-activities-for-kids/stem-science-questions-and-answers-for-kids-51-to-100/

No	Question	Answer
1	True or False: Dilithium crystals are fictional.	True. Dilithium Crystals are from the world of Star Trek.
2	What name is given to a giant cloud of dust and gas in space?	A nebula
3	In what decade was NASA founded?	NASA was founded July 29, 1958.
4	What chemical element is represented by Be?	Beryllium
5	What chemical element powered the DeLorean in Back to the Future?	Plutonium
6	How many patents did Thomas Edison file? 1093 / 308 / 669 / None	1093
7	What does a manometer measure?	Pressure
8	What does the Scoville Heat Unit Scale measure? Temperature of volcanoes Spiciness of chili peppers Temperature of sidewalks in summer The heat of computers and games consoles	The Scoville Scale is measurement of the pungency
9	What does SCUBA stand for?	Self-Contained Underwater Breathing Apparatus
10	What is a nanometer?	A nanometer is a unit of measurement equalling one thousand-millionth of a meter
11	Who invented the first battery?	Count Alessandro Volta
12	Name the tunnel construction company founded by Elon Musk.	The boring company
13	Name the sensory reaction of a tingling sensation on the skin/scalp popularized by YouTubers such as Gentle Whispering.	(ASMR) Autonomous Sensory Meridian Response
14	What chemical element is represented by Pb?	Lead
15	Who was the first person to win two Nobel Prizes for Science?	Marie Curie
16	What does LASER stand for?	Light amplification by stimulated emission of radiation
17	What is the name of the chemical reaction that causes toast to brown?	The maillard reaction
18	What is the name of the line that separates day and night on Earth? Hint: Arnie!	The terminator
19	Aside from fingerprints, what other human body part has a unique print?	The tongue
20	What food additive is made of crushed insects?	Carmine. It is red in color

21	Regardless of size, most mammals larger than a rat take roughly 21 seconds to do what?	Urinate
22	Which mammal was the first recipient of breast implants? Pig / Human / Orangutan / Dog	Dog
23	The infection herpes zoster is better known by what name?	Shingles
24	How many elements of the periodic table begin with the letter 'k'?	One. Kryptont
25	What animal has fingerprints almost identical to human fingerprints?	Koalas