Research Article

BRAIN HEMISPHERIC DOMINANCE AND DEMOGRAPHIC PROFILE OF SELECTED FILIPINO SENIOR HIGH SCHOOL STUDENTS: BASIS FOR THE WHOLE BRAIN TEACHING APPLICATION

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Abstract

This paper intends to assess the brain hemispheric dominance and demographic profile of the selected Filipino senior high school students. A cross-sectional study was conducted to the 120 senior high school students enrolled from one of the public schools in the Division of Surigao del Sur, Philippines. In this study, a researcher-made questionnaire was used to assess the demographic profile of the respondents in terms of age, sex, grade level, strand, handedness, and handedness, while their brain hemispheric dominance was identified using the standardized scale revised by Mariani (1996). The demographic profile revealed that the majority of the respondents were female, where most of them were at the age bracket of 16-17. Moreover, right-handedness was mostly present among the respondents, while Visayan and Surigaonon learners outnumbered other ethnicities. Statistical analysis also revealed that 78.33% (n=94) of the respondents belong to the left-brain category while 15% (n=18) were right-brained students and 6.67% (n=8) with whole-brained. However, there was no significant association of age, sex, grade level, strand, and handedness as to the learners' brain hemispheric dominance, except for the ethnicity. The findings of the study served as a basis in the formulation of appropriate strategies under the Whole brain teaching approach.

Keywords: Brain Dominance, Demographic Profile, Whole Brain Teaching Approach, Filipino Senior High School Students

Introduction

Cognitive neuroscientists defined brain hemisphericity as an individual difference to rely on what mode of cognitive processing preferred in performing an activity using their left and right brain hemisphere or combination (Mansour *et al,* 2017). According to Herrmann (as cited in Singh, 2015), brain dominance is expressed on how people learn, comprehend, and tell something. This elucidates further that each brain hemisphere contributes to a particular body function that constitutes the identity of a person. Likewise, having different brain dominance among a group of individuals depicts that each of us has a different way of understanding, interpretation, and application of the acquired information (Keat *et al*, 2016). Therefore, examining the students' brain hemispheric dominance and their profile plays an important role in designing appropriate teaching strategies to address learner's diversity with the end view to improve their academic performance.

Hughes (2007) stressed the implications of brain dominance in teaching as "*educators can use the results to develop a 'whole-brain' approach to teaching by designing courses that draw on general and dominance-specific methods"*. Therefore, it is suggested that every school should adopt the concept of hemisphericity to assess the characteristics of learners which will be used for planning to enhance classroom instructional delivery (Hunter, 1976; Torrance, 1981; Torrance, 1982). In fact, there were reported issues on mismatch used of teaching approaches in the classroom setting. Some teachers continuously rely on their comfort zone for the traditional way of teaching (Malacapay, 2019) without prior assessment of the learner's profile. The risk is that, when a learner's thinking or learning style mismatched to the teaching style of the teacher, students may not be motivated to learn which may even result in poor performance on tests (Singh, 2015). Previous studies revealed that there is a significant relationship between academic performance and brain dominance (Singh, 2015; Richard & Deirdre, 2013; Dhandabani & Sukumaran, 2015). This finding, therefore, implies that brain dominance plays a role to navigate learners to gain maximum learning.

Cognitive neuroscientists characterized learners with brain hemispheric dominance. Left-hemispheric dominant learners are logical, analytical, verbal, and with linear processing of information, while those right-hemispheric dominants are visual, tactile, global, relational, and with intuitive thinking (Ali & Kor, 2007; Savadkouhi *et al*, 2013). These mentioned characteristics are vital for the learners to be early diagnosed to prepare them for an engaging instructional activity. However, despite its significant application to education, limited studies had been conducted that deal with brain

dominance and its implication to teaching, therefore it is argued to examine the characteristics of a group of learners by looking into their brain dominance and demographic profile.

In the context of the Philippine K to 12 curriculums, the two years education in the senior high school aimed the students to prepare for tertiary learning, workforce, and global job market (Official Gazette, 2012). This current educational system is attuned also in the UNESCO (2014) agenda which aimed the students to develop 21st-century skills such as critical thinking, problem-solving, and effective communication. However, in this changing modern world, the left-brain hemisphere is not enough to be developed (Singh, 2015). The trend in jobs under the Industrial Revolution (InR) 4.0 requires more proportion of creative and intuitive thinking and the ability to perform (International Labor Organization, 2018; Singh, 2015). Hence, it is very important also to develop both hemispheres of the brain (left and right hemisphere) and utilize it as a whole (Singh, 2015). Likewise, to apply this construct into the classroom teaching (Mansour *et al,* 2017), it is deemed important to assess first the brain hemispheric dominance and demographic profile of the senior high school students, since the findings will serve as baseline information for lesson planning and formulation of appropriate teaching strategies (Montero, 2018; Olfaz, 2011) to attain successful application of Whole brain teaching approach.

Methodology

Research Design

This study employed the cross-sectional research design to obtain an answer to the main inquiry of the investigation**.** This research design was adopted since the aim of the study is to obtain a snapshot of a particular group of learners (Cherry, 2019; Cross-Sectional Research: Definition & Examples, 2014) with regards to brain hemispheric dominance and demographic profile of selected Filipino senior high school students. The study was conducted from the second week of October 2019 which was stretch out until the first week of November 2019.

Respondents

A total of 120 respondents were identified in the study using the purposive sampling procedure. Purposive sampling was employed, since the target participants are the senior high school students enrolled from one of the big schools in DepEd-San Miguel, Surigao del Sur, Philippines. Out of five strands implemented in DepEd-San Miguel, three (3) strands are presently offered at San Miguel National Comprehensive High School (e.g. Accountancy, Business & Management; Science, Technology, Engineering & Mathematics; and Technical Vocational Livelihood), which purposively chosen as a recipient of this study due to its large recorded diversity of students in terms of ethnicity. These students were

the intended purpose of this study, with the hope to unveil the brain dominance and demographic characteristics of these group of learners. However, for research ethical consideration, the sample per strand for every grade level was based on the number of students who have voluntarily participated or have an appreciation for the current investigation. Thus, Table 1 presents the distribution of the respondents per strand from Grade 11 to 12.

Table 1 Distribution of the Respondents

Grade Level	Strands			Total
	ABM	STEM	TVL	
Grade 11	20	18	22	60
Grade 12	21	25	14	60
Total	**41**	**43**	**36**	**120**

Instruments

In this study, two instruments were utilized to answer the main inquiry of the present investigation. The researcher-made questionnaire was used to assess the demographic profile of respondents such as age, sex, grade level, strand, handedness, and ethnicity. However, the brain hemispheric dominance of the respondents was assessed using the standardized scale revised by Mariani (1996). The said adapted instrument was utilized, since it has already been validated and its reliability has already been established and applied from the study of Ali and Kor (2007); Nandhini (2017). The adapted brain dominance questionnaire consists of 15 items of multiple choice type of test which comprises of 3 options per question. The questions are not categorized into three dimensions (e.g. left-brain, a right-brain, or a whole brain learner). The determination of the left-brain, right-brain, or whole-brain learners was done by counting the number of “A’s” and “B’s” as answered by the respondents. This was then calculated using the equation, -A + B. Subsequently, the result was interpreted using the following interpreting score:

-15 to -13 = Very Strong Left-brain dominance

-12 to -9 = Left-brain dominance

-8 to -5 = Moderate preference for Left-brain

-4 to -1 = Slight preference for left-brain

0 = Whole-brain dominance (bilateral)

+1 to +4 = Slight preference for right-brain

+5 to +8 = Moderate preference for right-brain

+9 to +12 = Right-brain dominance

+13 to + 15 = Very strong right-brain dominance

Data Collection and Analysis

Before the researcher administered the survey questionnaire, ethical consideration was observed like asking permission to the school principal and disseminating informed consent to the selected respondents. In this study, the respondents were informed about the purpose of the study, that their participation is voluntary and all the information would be treated with confidentiality. After getting the consent, the survey questionnaires were distributed with the help of the classroom advisers. The respondents involved are those who were present on the day of the administration of the questionnaire. After all the questionnaires were retrieved, the data were screened, tabulated, and subjected to statistical analysis using Past326b.exe. To analyze the brain dominance and demographic profile of the respondents, descriptive statistics was employed such as frequency count, percentage, mean, and standard deviation. On the other hand, the chi-square test on goodness-of-fit was utilized to examine the association between brain dominance and demographic profile in terms of age, sex, grade level, strand, handedness, and ethnicity.

Results

Table 2 Demographic profile of the respondents as classified according to their brain dominance (n=120)

Profile	Left-Brain Dominance		Right-Brain Dominance		Whole-Brain Dominance		Over-all Freq	Over-all %
	Freq	%	Freq	%	Freq	%		
Age								
16-17	48	40	9	7.5	6	5	63	52.50
18-19	41	34.17	8	6.67	2	1.67	51	42.50
20-21	5	4.17	1	0.83	0	0	6	5.00
Total	94	78.33	18	15	8	6.67	120	100
Mean ± SD	17.59 ±1.19 17.35		17.61 ±1.20		17 ± 0.87		17.55 ± 1.18	
95% CI	-17.83		17.06-18.16		16.40-17.60		17.34 - 17.76	

Profile	Left-Brain Dominance		Right-Brain Dominance		Whole-Brain Dominance		Over-all Freq	Over-all %
	Freq	%	Freq	%	Freq	%		
Sex								
Male	48	40	8	6.67	2	1.67	58	48.33
Female	46	38.33	10	8.33	6	5	62	51.67
Grade level								
11	43	35.83	11	9.17	6	5	60	50
12	51	42.5	7	5.83	2	1.67	60	50
Strand								
ABM	29	24.17	9	7.5	3	2.5	41	34.17
STEM	39	32.5	2	1.67	2	1.67	43	35.83
TVL	26	21.67	7	5.83	3	2.5	36	30
Handedness								
Left	12	10	1	0.83	0	0	13	10.83
Right	82	68.33	17	14.17	8	6.67	107	89.17
Ethnicity								
Visayan	41	34.17	8	6.67	5	4.17	54	45
Bol-anon	1	0.83	0	0	0	0	1	0.83
Ilocano	2	1.67	0	0	0	0	2	1.67
Ilonggo	3	2.5	0	0	0	0	3	2.5
Kamayo	0	0	0	0	1	0.83	1	0.83
Manobo	6	5	4	3.33	0	0	10	8.33
Surigaonon	41	34.17	7	5.83	1	0.83	49	40.83

Of the 120 respondents, the majority were at the age bracket of 16-17 (52.50%) and with an overall mean age of 17.55 (SD=1.18). Among them, female (51.67%) learners dominate than male counterparts while an equal number of respondents manifested from grade 11 and 12. It further revealed that male participants had 48 (40%) left-brain preference, 8 (6.67%) had right-brain preference and 2 (1.67%) had whole brain preference. Meanwhile, among female participants had 46 (38.33%) left brain preference, 10 (8.33%) had right-brain preference and 6 (5%) had whole brain preference. Findings of this study also showed that 35.83 percent of the respondents are coming from the STEM followed by ABM (34.17%) and TVL (30%). Furthermore, right-handedness (89.17%) was mostly present among

the respondents, while Visayan (n=41, 34.17%) and Surigaonon (n=41, 34.17%) outnumbered other ethnicities. In general, 78.33% (n=94) of the respondents belong to the left-brain category while 15% (n=18) were right-brained students and 6.67% (n=8) with whole-brained.

Table 3 Differences between brain dominance (left, right, and whole-brain) and demographic profile of the respondents (n=120)

Variables	Df	X^2	p-value	Decision	Interpretation
Age	4	1.8801	0.758	Accept Ho	Not Significant
Sex	2	2.1338	0.344	Accept Ho	Not Significant
Grade level	2	3.5697	0.168	Accept Ho	Not Significant
Strand	4	6.6163	0.158	Accept Ho	Not Significant
Handedness	2	1.8545	0.396	Accept Ho	Not Significant
Ethnicity	12	25.126	0.014	Reject Ho	Significant

Note: Significant at $p < 0.05$

Table 3 presents the association between brain dominance and demographic profile. Using the chi-square test of goodness of fit at 0.05 level of significance, this study revealed that the demographic profile of the respondents such as age (x^2 = 1.8801, p-value = 0.758), sex (x^2 = 2.1338, p-value = 0.344), grade level (x^2 = 3.5697, p-value = 0.168), strand (x^2 = 6.6163, p-value = 0.158), and handedness (x^2 = 1.8545, p-value = 0.396) has no significant association to their brain dominance, except only for the ethnicity (x^2 = 25.126, p-value = 0.014).

Discussion

This cross-sectional study aimed to determine the brain dominance and demographic profile of the respondents. Thus, this portion gives a thorough discussion relative to the significant implication of the findings. The present study revealed that the majority of the respondents were at the age bracket of 16-17, where most of them are left-brain dominant. In terms of age association towards brain hemispheric dominance, findings in Table 3 revealed that there is no significant association. This result supports the findings of Mansour *et al* (2017) and Keat *et al* (2016) but contradicts the study of Singh (2015). The present findings also imply that the brain dominance of the learners does not rely on age. In other words, it is independent and not influenced by age. Even though the left-brain dominant learners have

emerged as the most numbered individuals as shown in their age intervals, the present findings could still consider that there is a diversity of cognitive style that exists among the respondents.

Furthermore, the result of the study adds to the previous studies, including Singh *et al* (2011) and Singh (2015), showing that males were more left-brain than female learners. Conversely, the present findings disclosed that female learners have more right brain and whole brain learners than their male counterparts. Moreover, each grade level (e.g. grade 11 & 12) shows that there were more left-brain learners in grade 12 than in grade 11 but more right brain and whole brain learners observed among grade 11 students. However, the present findings contradict the study of Nandhini (2017), where males have more right-brain learners. The findings also are inconsistent to the previous literatures (Koju *et al*, 2019; Singh, 2015; Singh *et al*, 2011; Van der Jaght, 2003). Moreover, the result in Table 3 revealed that there is no significant association of sex and grade level towards the brain hemispheric dominance of senior high school students. The result implies that the brain dominance of the learners is not influenced by their sex and grade level; hence, these two variables are independent. Although brain dominance has no significant association to students' sex and their grade level, it is still considered as one of the important aspects in the context of individual differences.

Findings also of this study showed that 35.83 percent of the respondents are coming from the STEM followed by ABM (34.17%) and TVL (30%), wherein the majority belonged to the left-brain category. This result undeniably shows that the majority of the participants are left-brain learners which is congruent with the findings by Keat *et al* (2016); P. Singh (2015); Fernandez (2011); Ali & Kor (2007); and Van der Jaght *et al* (2003). Since the present study is new to this kind of respondents, it could be inferred that the present findings may be different from other geographical locations. For instance, the cross-sectional study of Koju *et al* (2019) on hemispheric brain preference of medical students in Nepal showed that the majority had no clear brain preference. Koju *et al* (2019) suspected the role of other extraneous factors such as economic factors and the weak association between hemispheric brain dominance and the choice to study medical courses. In the study of Szirony *et al* (as cited in Koju *et al*, 2019), right hemispheric preference was mostly observed to have a preference towards business administration, while the learners with left hemispheric preference tend to choose liberal arts. In the context of this study, the result is different. The findings show that there is no significant association between the strands and brain hemispheric dominance of the respondents. The choice of the senior high school students towards strands (e.g. STEM, ABM, and TVL) is not evident to the study of Szirony *et al* (2007), since the present findings of the study is obvious that majority of the learners belong to left-brain category.

Thus, it agreed with the findings of Koju *et al* (2019) that brain hemispheric preference may not be used as a reference in the choice of career of the students.

On the other hand, the manifested diversity of brain hemispheric dominance across the three strands indicates that students have different understanding, interpretation, and application of the acquired information (Keat *et al*, 2016). Thus, Koju *et al* (2019) recommended a good mix of teaching strategies. This good mix of teaching strategy is a combination of different teaching strategies, which is similar to the concept of Whole brain teaching approach as a form of differentiated instruction (Biffle, 2013). In fact, this Whole brain teaching approach had been reported in various works of literature (Torio & Cabrillas-Torio, 2016; Banwaneh *et al*, 2011; Sontillano, 2018). All these agreed that this application to teaching has a positive influence on the learning performances of the students. Some suggested teaching techniques of Biffle (2013) involved the use of seven big ideas under direct instruction such as 1) Class-Yes; 2) Five Classroom rules; 3) Teach-Okay; 4) Scoreboard; 5) Hands and Eyes; 6) Switch; and 7) Mirror. Likewise, some classroom strategies under the Hermann Whole Brain Teaching method include independent manual work, experimentation, cooperative learning group, and practical displays (Torio & Cabrillas-Torio, 2016). This implies that brain hemispheric dominance and demographic profile of the learners may still be used as baseline data to improve the classroom learning delivery.

Aside from this, it was found out also that right-handed (89.17%) learners are more numerous than those left-handed learners. The result agrees with the study of Keat *et al* (2016), where 95.2 % of the respondents were right-handed. It could be noticed also that majority of the respondents were left-brain dominant. Therefore, it confirms that the left-brain hemisphere controls the right side of the body such as our right hand. According to Nandhini (2017), ninety percent of the student's population is right-handed. This could be inferred that 90 % of the population's left hemisphere is controlling the important movements such as writing, eating, driving, washing, and typing. Likewise, the result of the present study is similar, which affirmed that more than half (78.33 %) of the respondents belong to the left-brain category. This suggests that in implementing the Whole brain teaching approach, the use of body movements and hands-on activities plays an important role to cater the diversity of learners. However, the results revealed that there is no significant association between handedness and the brain hemispheric preference of the learners. The result coincides with the findings of Koju *et al* (2019); Keat *et al* (2016); Albert (1989); and Fanning (1983) but not coincide with the study of Mohamed (2012). The non-significant result may be attributed to the individual differences of brain hemispheric orientation. Previous studies (Manzano & Ullen, 2018; Lenroot & Giedd, 2008) reported that this diversity could be

influenced by the complex interactions of genetic and environmental factors. Mansour *et al* (2017) claimed that this hemispheric diversity can be used to navigate learners to earn maximum learning. Thus, the present findings add in the context of the past literatures (Dhandapani & Sukumaran, 2015; Neal, 2013), which argued that brain dominance can be used to upgrade the learning performance of the learners.

Lastly, the findings also revealed that the majority of the respondents were Visayan and Surigaonon. In this study, most of the students are local inhabitants of San Miguel, Surigao del Sur while some are local migrators to this municipality from its neighboring municipalities and provinces. The result is similar with the findings of Alvaro (2006), where most of her respondents were Visayan learners. The result in Table 3 indicates that there is a significant association between the brain hemispheric dominance and ethnicity of the respondents. According to Dhandabani and Sukumaran (2015), thinking styles are influenced by the cultural settings and medium of instruction used in school. In a published article of Morales (2014a) on the cultural and epistemological profile of Filipino learners, it disclosed that each ethnic group of learners in Luzon (e.g. Tagalog, Bicol, and Pangasinan) have distinct learning characteristics. This shows that ethnicity or cultural background is considered as one of the factors that influence cognitive style and motivation of the learners. Likewise, in her one study (Morales, 2014b) suggested that native language must complement the culture of the learners to achieve a better understanding of the lesson. Hence, it can be argued that these findings can be applied in designing the instructional strategies such as direct instruction via Biffle's Whole Brain Teaching (WBT) approach. For example, in implementing the Class-Yes learning syntax to the students, native language may be used to effectively catch the student's attention. In designing the Five Classroom rules, the teacher may ask suggestions to the learners to obtain consensus decisions on classroom rules despite their cultural diversity. Also, for Teach Ok, the teacher may localize or contextualize some questions that are linked to the daily life situations and real activities of the learners. However, to motivate the learners in doing the classroom activity, the use of Scoreboard is suggested. Aside from the score obtained for every correct response, the use of reward system may be employed using the available resources within and outside the school. Also, for *Switch* learning syntax, as much as possible equal opportunity shall be given to all interested students for expressing their answers and opinions, be it group or individual activity. The principal objective is to establish equity among them despite their ethnic diversity.

Moreover, in the case of Hermann Whole Brain Teaching (WBT) approach, the integration of contextualization, indigenization, or localization of activities (based on the student's daily life activities)

may be applied for individual and cooperative learning groups. In fact, a study of Morales (2017) showed that culture-influenced instructional activity helped the students achieve a conceptual understanding of the lesson. Therefore, some strategies like physical activities (Constantino *et al*, 2017) may be integrated into learning activity to allow the students appreciate the relevant application of the lesson to their daily life activities. Although there may be several things to consider in implementing the WBT approach, knowing the students' profile and their brain hemispheric preference may significantly affect in designing instructional strategies suitable for the whole brain teaching application.

Limitation and Suggestion for Future Studies

Since the present study is a cross-sectional study aimed to assess the senior high school students' profile and brain dominance, the findings cannot represent the entire Filipino students. Thus, this recommends future studies using a longitudinal study and a large size group of participants to other geographical settings to examine also other variables like learning style, study habits, and academic performance, concerning the brain hemispheric dominance of senior high school students. This study will have a huge contribution to validate and understand clearly the relation to their brain hemispheric orientation. Given also with the scanty of literature to support the foregoing investigation, it is encouraged to explore further the association between ethnicity and the brain dominance to obtain a comprehensive understanding with regards to this aspect. Moreover, conducting studies to other geographic locations need to consider cultural sensitivity to observe ethical issues while conducting a similar study.

Conclusion

The present study provides significant insights to the educator before the utilization of the Whole brain teaching approach. In this study, left-brain dominant learners outnumbered the learners with right-brain and whole-brain dominance**.** Therefore, it is argued to take into account the learner's thinking style according to their brain hemispheric orientation. However, to stimulate further the right-brain hemisphere, whole brain teaching is suggested to apply both hemispheric dominance while taking into consideration that ethnicity or cultural perspective of the learners may significantly contribute differences in their way of learning to school. This study argued that in designing teaching strategies, one thing also to consider is the ethnicity of the learner. Thus, the more the teacher will engage in capacity building programs, the more they are competent enough in implementing the Whole brain teaching approach to their learners. Also, more research shall be conducted to explore innovative

activities (under whole brain teaching) that may strengthen the brain hemispheric orientation of the learners.

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