



RESEARCH ARTICLE

EVALUATION OF HEMISPHERICAL DOMINANCE/BRAIN LATERALIZATION AMONG HEALTH PROFESSIONALS IN ANDHRA PRADESH: A CROSS SECTIONAL STUDY

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ABSTRACT

**Introduction:** Human brain often is envisioned as the most intricate structure in the universe. About 150 years ago, scientists realized that the two sides of the human brain, right and left, are different in magnitude, anatomy, and their areas of strength which is commonly termed as hemispheric specialization or brain lateralization. It has been hypothesized that left brained individuals are more verbal, linear, rational, logical, and analytical in their thinking, while right brained individuals are more intuitive, creative, non verbal. In today's world, it is important to develop 'Whole brain thinking', that is the capability to be a right brain thinker in situations that require creativity, intuition and to be a left brain thinker when the scenario demands logic and rationality.

**Objective:** To understand the general hemispheric dominance and the consequent traits of budding health professionals from three different backgrounds with respect to their nature and scope of practice.

**Methodology:** A pretested, self administered questionnaire with 40 questions was used to assess the hemispheric dominance among students from three different health professions namely dentistry, nursing, and pharmacy, studying in relatively homogenous area with respect to geography and socioeconomic conditions. Descriptive statistics, Mann-Whitney U test, Kruskal Wallis ANOVA, Chi-square tests were used to analyse the data.

**Results:** There were no significant differences in the mean left brain and right brain scores between students from different health professions. Though mean right brain scores were found to be lower compared to mean left brain scores, this difference was not statistically significant. There were no gender differences in the mean left and right brain scores as well.

**Conclusion:** In view of the challenging nature of health profession and the role these professionals have to assume in future, it is important for these professionals to develop whole brain thinking, and necessary strategies have to be integrated in the health care curriculum.

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INTRODUCTION

Human brain often is envisioned as the most intricate structure in the universe. It is so intricate that the capability of human brain comes to naught in discerning its complexity (Christof Koch and Patricia Kuhl, 2013). Human brain is divided into two well defined cerebral hemispheres by median longitudinal fissure which are identical in their macrostructure (Rita Carter et al, 2009). About 150 years ago, scientists realized that the two sides of the human brain, right and left, are different in magnitude, anatomy, and their areas of strength. This difference is commonly termed as hemispheric specialization or brain lateralization (Kenneth Hugdahl and Rene Westerhausen, 2010).

Similarly, human beings are not lateralized in the same way. For a given person, some cognitive processes incline to be more commendable in one hemisphere than the other. Psychologists associate preferences for hemispheric specializations with patterns of thought and innovation. It has been hypothesized that left brained individuals are more verbal, linear, rational, logical, and analytical in their thinking, while right brained individuals are more intuitive, creative, non verbal (Sarah Cook, 2007). For instance, when a group of employees planned to play a friendly game of cricket (right hemispheric activity), they could not enjoy the essence of the game, the fun, if they are excessively concerned with the affairs of left hemisphere like rules and discipline. Nevertheless, in every activity both the hemispheres participate to some extent. The concept of brain lateralization plays a key role in leadership abilities. Leadership is described as the

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performance of an individual in the course of steering the actions of a group towards a common goal (Arul Lawrence A.S, 2012). The role of a leader demands the ability of influence, persuasion, and being amenable to change. Though it is cardinal to lead depending on one's own style, it is equally important to discern our inclinations as a basis to build upon with diversity in thought process and action. In today's world, it is important to develop 'Whole brain thinking', that is the capability to be a right brain thinker in situations that require creativity, intuition and to be a left brain thinker when the scenario demands logic and rationality (Herrmann N, 1996). Health care professionals encounter a wide range of complex situations owing to the arduous nature of their professions. Consequently, brain lateralization among health care professionals is of great significance not only to realize the general orientation of these professionals, but also to develop strategies towards achieving whole brain thinking particularly in view of the increasing demands of the profession. This concept of brain lateralization or hemispheric dominance among health professionals acquired least attention by researchers. With this background, the aim of the present study is to understand the general hemispheric dominance and the consequent traits of budding health professionals from three different backgrounds with respect to their nature and scope of practice.

## MATERIALS AND METHODS

The study was conducted in the neo capital region of Andhra Pradesh, India. Students from three different professions relating to health were included in the study. The three professions considered in the present study are dentistry, pharmacy, and nursing. All the selected institutions are situated within a relatively homogenous area with respect to geography and socioeconomic conditions. A pretested, self administered questionnaire was used to assess the hemispheric dominance of the study participants. The questionnaire consisted of 40 items relating to the personality of the participant to be graded on a 5 point likert scale. All the 40 items were tested for ease of understanding by conducting cognitive interviews among a group of 15 participants.

It was observed that a majority of the participants had difficulty in interpreting few items which were modified to increase the validity of the questionnaire. However, all the terms were described to the participants to avoid bias based on level of terminological understanding. To ensure uniformity, students from final year of under graduation were included from all the three types of colleges namely dental, pharmacy, and nursing. the study sample consisted of 162 participants with 80 students from nursing college, and 41 each from dental and pharmacy colleges. Informed consent was obtained from all the participants before participating in the study. The study protocol was reviewed and approved by the institutional ethical committee. The study was conducted between August, 2015 and September, 2015. SPSS V20 software was used to analyze the data. Descriptive statistics were used whenever required. Kruskal wallis ANOVA was used to compare the Left brain and Right brain scores between students from different professional backgrounds. Independent samples t test was used to compare Left and Right brain mean scores based on gender. Chi square test and Fisher's Exact Test were used to compare the proportions of the personal and academic time management skills that were scored on a likert scale between students from

different professional background and also based on their hemispherical dominance.

## RESULTS

The study was conducted on 163 students from health care profession. Of the 163 participants, 80 were from nursing, 43 from dentistry, and 40 were from pharmacy, accounting for 49.07%, 26.38%, and 24.53% respectively. 83.44% of the study participants were females. The questions were segregated into two categories of 20 each: left brain questions; right brain questions, as assigned in the original questionnaire. The possible score in each category ranges from a least of 20 to a highest score of 80. The mean (S.D) left brain scores of the nursing students, dental students, and pharmacy students were 74.44 (2.63), 74.51 (3.09), and 74.53 (2.96) respectively.

There was no significant difference in the mean left brain scores between these groups ( $p = 0.957$ ) (Table 1). Comparatively higher mean right brain scores were found among Pharmacy students followed by dental and nursing students. However, the differences in these scores is not statistically significant ( $p = 0.795$ ) (Table 1). Table 2 shows the differences in mean left brain scores and right brain scores based on gender. No significant differences were observed. Figure 1 shows the dominance profile of the study participants. The degree of preference for a particular hemisphere was calculated for all the participants by subtracting the total left brain scores from the total right brain scores. A positive score suggests left hemispheric dominance, while a negative score suggests right hemispheric dominance. The magnitude of the score highlights the degree of preference, with higher scores suggesting higher degree of preference in any direction. The dominance scores ranged from -7 to +21. There were only 5 participants with right hemispherical dominance (3.06%). The mode of the dominance profile was found to be 13 towards left hemispheric dominance.

The dominance profile was segregated into 5 categories, with each category containing 5 scores, transforming it to an ordinal dominance profile as shown in Figure 2. The sign (direction of dominance) was ignored to facilitate statistical analysis. The mode of ordinal dominance profile was found to be 3 (dominance scores ranging from 11-15). Table 3 shows the differences in personal time management skills of the participants based on their profession and hemispheric dominance. All the participants rated their personal time management skills either as good or very good on a 4 point likert scale. There were no differences between students from the three professions in their personal time management skills ( $p = 0.724$ ). Similarly, no significant differences were found between the participants based on hemispheric dominance ( $p = 0.399$ ). Differences in the academic time management skills of the study participants based on professional group and hemispheric dominance were shown in Table 4. Unlike personal time management skills, academic time management skills of the participants were distributed across three categories: poor; good; very good. No significant differences were found in the academic time management skills based on the profession ( $p = 0.929$ ). Nevertheless, hemispheric dominance as an independent variable has shown a near significant difference in the academic time management skills of the study participants ( $p = 0.058$ ).

**Table 1. Differences in Total Left Brain(LB) scores and Total Right brain(RB) scores based on professional background**

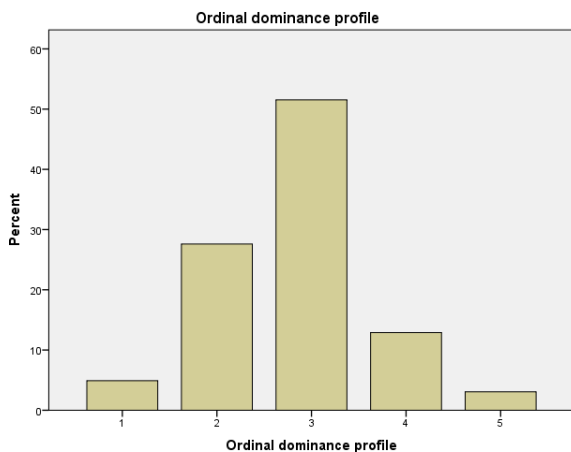
Professional background	N	Total LB score		P value	Total RB score		P value
		Mean (sd)	Mean rank		Mean (sd)	Mean rank	
Nursing	80	74.44(2.63)	80.92	0.957	62.55(3.31)	80.05	0.795
Dental	43	74.51(3.09)	82.76		62.60(3.09)	81.74	
Pharmacy	40	74.53(2.96)	83.35		63.03(3.52)	86.18	

Kruskal wallis Anova

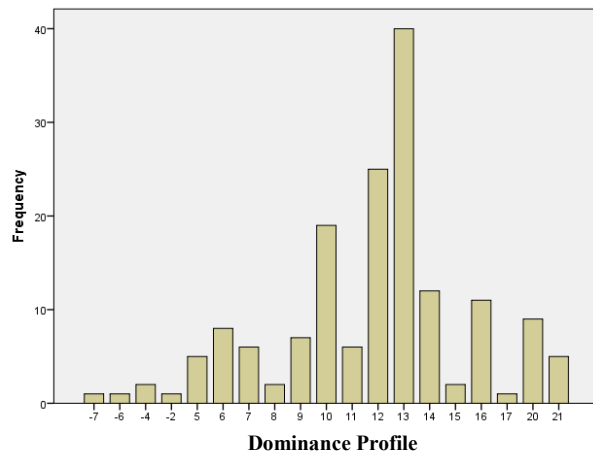
**Table 2. Differences in Total Left Brain (LB) scores and Total Right brain (RB) scores based on gender**

Gender	N	Total LB score mean(sd)	P value	Total RB score mean(sd)	P value
Male	27	74.56 (3.693)	0.877	63.37 (3.804)	0.232
Female	136	74.46 (2.638)		62.54 (3.157)	

Independent samples t-test



**Figure 2. Categorical distribution of the ordinal dominance profil**



**Figure 1. Distribution of the dominance profile of the study participants**

**Table 3. Differences in personal time management of the study participants based on professional background and hemispherical dominance**

	Group	Group			P value	Hemispherical dominance		P value
		1	2	3		Left	Right	
Personal time management	3	52 (65%)	25 (58.1%)	24 (60%)	0.724	97 (61.4%)	4 (80%)	0.399
	4	28 (35%)	18 (41.9%)	16 (40%)		61 (38.6%)	1 (20%)	

Chi-square test

**Table 4. Differences in academic time management of the study participants based on professional background and hemispherical dominance**

	Group	Group			P value	Hemispherical dominance		P value
		1	2	3		Left	Right	
Academic time management	2	17 (21.2%)	7 (16.3%)	7 (17.5%)	0.929	28 (17.7%)	3 (60%)	0.058
	3	58 (72.5%)	34 (79.1%)	30 (75%)		120 (75.9%)	2 (40%)	
	4	5 (6.2%)	2 (4.7%)	3 (7.5%)		10 (6.3%)	0 (0%)	

Fisher's Exact Test

The dominance profile was segregated into 5 categories, with each category containing 5 scores, transforming it to an ordinal dominance profile as shown in Figure 2. The sign (direction of dominance) was ignored to facilitate statistical analysis. The mode of ordinal dominance profile was found to be 3 (dominance scores ranging from 11-15). Table 3 shows the differences in personal time management skills of the participants based on their profession and hemispheric dominance. All the participants rated their personal time management skills either as good or very good on a 4 point likert scale. There were no differences between students from the three professions in their personal time management skills (p = 0.724). Similarly, no significant differences were found

between the participants based on hemispheric dominance (p = 0.399). Differences in the academic time management skills of the study participants based on professional group and hemispheric dominance were shown in Table 4. Unlike personal time management skills, academic time management skills of the participants were distributed across three categories: poor; good; very good. No significant differences were found in the academic time management skills based on the profession (p = 0.929). Nevertheless, hemispheric dominance as an independent variable has shown a near significant difference in the academic time management skills of the study participants (p = 0.058).

## DISCUSSION

It is an established notion that the left hemisphere of brain is related to language, logic, and thinking, while the right hemisphere of brain is more related to creativity and intuition. However, it was out rightly acknowledged that none of these activities are exclusively either right brained or left brained. The concept of lateralization both in terms of structure and function, commonly referred to as structural lateralization and functional lateralization respectively, was also a widely acknowledged phenomenon (Sarah Cook, 2007). In the present study, it was observed that the mean left brain scores were higher compared to right brain scores. The dominance profiles obtained suggest that majority of the participants have left hemispheric dominance. The most common ordinal dominance profile was found to be '3' suggesting that majority of participants have left brain scores considerably higher compared to right brain scores with a margin of 11 - 15. It was identified in this study that brain lateralization does not significantly affect the personal and the academic time management skills of the individuals. Health care professionals are bound to interact with the society to a much larger extent compared to other professionals, either directly or indirectly. This demands additional qualities from these professionals like leadership, ability to multitask, coordinate with other sectors etc, besides professional expertise. In this context, health care professionals would benefit if they develop whole brain thinking, and consequently the profession. So, despite the fact that functioning of brain was never completely understood (Michael Corballis, 2014), the existing knowledge on brain functioning must be incorporated into teaching practices in health care curricula. This incorporation of neuroscience into education though looks promising, faces challenges in implementation because of the pragmatic difficulties in converting insights into implementable strategies (Morris, 2006). The concept of Whole Brain Teaching (WBT) was introduced by Chris Biffle in the year 1995 (Biffle, 2010). There is considerable amount of evidence suggesting improvement in students' academic achievement with WBT. Research also suggests that improvement in academic achievements is strongly related positively to improved academic self - concept (Shavelson *et al*, 1976; Marsh and Martin, 2011).

## Conclusion

In view of the results obtained from this study and the scientific evidence highlighting the benefits of WBT and Whole Brain Learning, it is recommended that the apex bodies of various fields relating to health care must make policy guidelines ensuring the implementation of WBT in order to make the health care professionals more equipped with a wide range of skills they would require in future.

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