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Original Research Article

# Hemispheric Brain Preference and Academic Parameters in Medical Students: A Cross-sectional Study

Bibek Koju,[a,c] Lok Raj Joshi,[a,c] Shaligram Chaudhary,[a,c] Anupama Shrestha[b,d]

**ABSTRACT:**

**Introduction:** Hemispheric brain preference means using one side of the brain over the other to learn. Hemispheric brain preference may influence one's learning style. This study aimed to investigate hemispheric brain preference and its relation with academic parameters in medical students. **Methods:** Four hundred participants were included in the study by cluster random sampling. Using self-administered questionnaires, data on personal profile (name, age, sex, handedness, academic score, study method, study hours per day and study pattern) and hemispheric brain dominance was collected. Open Hemispheric Brain Dominance Scale 1.0 (2015) was used to determine the hemispheric brain dominance. **Results:** Participants having no clear hemispheric brain preference (46.75%) were in majority followed by those with left hemispheric brain preference (29.25%) and then those with right hemispheric brain preference (24%). There was a statistically significant difference in academic scores of students with different hemispheric brain preference (p=0.021). Students with left brain preference had the highest academic score (63.85±11.78) and those with no clear preference had the lowest (59.96±11.64). Also, students with left hemispheric brain preference would study more regularly and would spend more time in study per day. **Conclusion:** In our sample**,** participants with left hemispheric brain preference were found to have the highest mean academic score but they also spent more time in study and also studied regularly throughout the semester. As this study shows diversity in brain preference among medical students, we recommend a good mix of various teaching learning methods for better learning of the entire class.

**Key words: Handedness, Hemispheric brain preference, Learning, Medical students**

## INTRODUCTION:

Hemispheric brain preference means using one side of the brain over the other to learn.[1] Each of the cerebral hemispheres play an important but distinctive roles.[2] Left brain is the seat of self-motivated behavior and is responsible for logical, rational, cognitive and conscious knowledge.[3] Left brain is better in understanding language and skilled movements. Right brain is better at discrimination of shapes, spatial relationships and expressing emotions.[4,5] Certain non verbal functions are handled by right brain.[2] It is also associated with intuition, empathy, creativity and flexibility.[3] It has been shown that hemisphericity may influence choice of occupations and performance. For example: people with right hemispheric preference were found to be preferring business/administration while those with left hemispheric preference prefer to do liberal arts.[6]

Medical students need to develop wide range of skills some of which are domains of the left brain and others of the right brain. Logical

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a - Lecturer, Department of Physiology
b - Lecturer, Department of Anatomy
c - Lumbini Medical College and Teaching Hospital, Palpa, Nepal.
d- Kathmandu University School of Medical Sciences, Dhulikhel, Nepal.
**Corresponding Author:**
Bibek Koju
e-mail: believebibek@gmail.com
ORCID: https://orcid.org/0000-0002-5882-2707

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thinking, fine surgical skills, problem solving, organizing concepts are domains of the left brain. Analysis and memorization of visual information and spatial anatomical relationships, empathy, communication, flexibility come under right brain domains.[7,8] Critical thinking and communication skills are important for health professionals and their acquisition is affected by the individual learning style.[9,10]

Knowledge of the relationship between hemispheric brain preference and academic score in medical students gives an idea about learning styles of better performing medical students. It can also help both students and educators to apply effective teaching-learning methods to improve their performance.[11] To the best of our knowledge, there are only a few studies that have investigated the association between hemispheric brain preference and academic score in health science students and even fewer in medical students. One study has found that hemispheric brain preference has a significant influence on medical students' examination score.[12] However, some studies have suggested that brain preference has no effect on student's examination score.[1,13] Amidst these inconsistent findings, the present study aimed to further investigate the issue i.e. hemispheric brain preference and its relation with academic score in medical students.

## METHODS:

We conducted a cross-sectional analytical observational study in the Department of Physiology, Lumbini Medical College (LMC), Pravas, Tansen, Palpa. The study was carried out from 21$^{st}$ January 2019 to 4$^{th}$ March 2019. All healthy male and female participants aged 18–25 years willing to participate voluntarily were included. Those students having any physical or psychomotor impairment, refusing to sign the written consent, who could not complete self administered questionnaires and who were absent at the time of data collection were excluded from the study. Out of seven batches of MBBS students (5$^{th}$-11$^{th}$ batches), five batches (7$^{th}$-11$^{th}$ batch) were taken in this study by cluster random sampling.

Ethical clearance was obtained from Institutional Review Committee of the institute (IRC-LMC 05-J/018) prior to data collection. The sample size was calculated using the formula, $n=z^2pq/d^2$ and it was found to be 366. Final sample size was 400 participants, taking 10% of attrition.

Four hundred participants who fulfilled the eligibility criteria were included in the study after prior explanation about the purpose of study. Informed consent was obtained in writing. All participants were tested under same setting in comfortable environment. The participants were called in groups of 10-12 individuals in the tutorial room of Department of Physiology of LMC. The data was collected using structured self-administered questionnaires in the presence of the author/s and any queries regarding the questions were made clear. The questionnaire consisted of questions on personal profile and Open Hemispheric Brain Dominance Scale 1.0.

The questions on personal profile collected information about age, sex, handedness, academic score, study method, study hours per day and study pattern of the participants. Handedness refers to the tendency to use one hand in preference to the other. One may be right handed or left handed or can use both hands equally. Score in the last exam that the participant attended (percentage of full marks) was considered as the academic score. Study methods were classified as individual, group or both. Study hour per day refers to the average time that one spends to study outside the routine classes. Study pattern says whether one spreads one's study time throughout the semester or concentrates only a few weeks prior to the examination.

The open hemispheric brain dominance scale (OHBDS) was developed by Eric Jorgenson (2015).[14] He developed it by selecting items based on correlations with five diverse other published scales commonly used to measure the construct: The Alert Scale of Cognitive Style,[15] The Wagner Preference Inventory,[16] Philip Carter's test,[17] Madeline Turgeon's questionnaire[18] and The Polarity Questionnaire.[19,20] For each of the five scales Eric Jorgenson selected four items on the basis of Pearson correlation from a pool of 80, yielding the 20 items of the OHBDS 1.0. According to the respondent's answers, calculation was done to determine if the respondent has right, left or whole brain preference.[14] Educational researchers have used OHBDS 1.0 for the determination of hemispheric dominance.[21] We also had pre-tested the questionnaire to ensure its clarity in our setting. Internal consistency was tested with Cronbach's alpha which was found to be 0.71.

The data was compiled and analyzed using

SPSS 16.0. ANOVA was used to test relationship of hemispheric brain preference with academic score. Chi-square test was applied to evaluate relationship of hemispheric brain preference with handedness, study hours per day (<1 hr/day, 1-3 hr/day and >3 hr/day), study method (group, individual and both) and study pattern (throughout the semester or few weeks prior to exam). Independent sample t-test was used to test relationship between academic score with study pattern. p-value less than or equal to 0.05 was considered statistically significant.

**RESULTS:**

The study included 400 participants with mean age of 21.13 (SD = 1.945) years. Among them, 232 (58%) were male participants and 168 (42%) were female participants. Out of them, 117 (29.25%) participants had left brain preference, 187 (46.75%) participants had no clear preference and 96 (24%) participants had right brain preference. Among male participants, 73 (31.47%) had left brain preference, 110 (47.41%) had no clear preference and 49 (21.12%) had right brain preference. Among female participants, 44 (26.19%) had left brain preference, 77 (45.83%) had no clear preference and 47 (27.98%) had right brain preference. Fifteen participants (3.75%) were left handed, 359 (89.75%) participants were right handed and 26 (6.50%) participants could use both of their hands equally. The mean academic score of the participants was 61.43% (SD= 11.92). There was no difference in academic score of male and female participants. Seventy five (18.75%) participants would study less than 1 hours per day, 264 (66%) participants would study 1-3 hours per day and 61 (15.25%) participants study more than 3 hours per day. Most of the participants, 340 (85%) preferred to study individually, 43 (10.75%) preferred to study in group and 17 (4.25%) preferred both methods for studying. Less than half participants (185, 46.2%) would study throughout the semester and remaining participants (215, 53.8%) concentrated to study only a few weeks prior to examination.

Table 1 shows statistically significant difference among mean academic scores of participants with different hemispheric brain preference as determined by one way ANOVA ($F(2,397)=3.882$, $p=0.021$). A Tukey post hoc test revealed that academic score of participants with left brain preference (63.85±11.78) was statistically significantly higher than academic score (59.96±11.64) of those with no clear preference ($p=0.015$). However, there was no statistically significant difference ($p=0.272$) in academic score of left preference and right preference (61.33±12.24) or academic score of no preference and right preference ($p=0.626$).

*Table 1: Academic score in percentage of students and hemispheric brain preferences.*

| Hemispheric Brain Preference (400) | Academic Score (Mean±SD) | Statistics |
|---|---|---|
| Left Brain Preference (117) | 63.85 ± 11.78 | F (2,397) = 3.882, p = 0.021 |
| No Clear Preference (187) | 59.96 ± 11.64 | |
| Right Brain Preference (96) | 61.33 ± 12.24 | |

This study did not find significant association between handedness and hemispheric brain preference ($p=0.298$). Similarly, there was no association between study method (individual/group/both) and hemispheric brain preference (0.300).

Table 2 shows significant association between hemispheric brain preference and study pattern ($\chi^2[N=400, df=1]= 19.22$, $p<0.001$). Among left brained participants, 63.25% would study throughout the semester. However, only 37.97% of the participants with no clear preference and 41.67% of participants with right brain preference would study throughout the semester.

*Table 2: Hemispheric Brain Preference and Study Pattern.*

| Hemispheric Brain Preference (400) | Study Pattern n(%) | | Statistics |
|---|---|---|---|
| | Throughout the Semester (185) | Few Weeks Prior to Exam (215) | |
| Left Brain Preference (117) | 74 (63.25) | 43 (36.75) | $\chi^2$ [N = 400, df =1] = 19.22, p <0.001 |
| No Clear Preference (187) | 71 (37.97) | 116 (62.03) | |
| Right Brain Preference (96) | 40 (41.67) | 56 (58.33) | |

Table 3 shows that the proportion of participants who studied less than one hour per day was the highest in those with no clear preference category (24.06%) followed by those with right brain preference (20.83%) and left brain preference (8.55%). This difference was found to be statistically significant ($\chi^2$[N=400, df=4]= 13.23, p=0.010).

*Table 3: Hemispheric brain preference and study hours per day.*

| Hemispheric Brain Preference (400) | Hours of Study Per Day n(%) | | | Statistics |
|---|---|---|---|---|
| | <1 hr/ day | 1-3 hr/ day | >3 hr/ day | |
| Left Brain Preference (117) | 10 (8.55) | 83 (70.94) | 24 (20.51) | $\chi^2$ [N = 400, df = 4] = 13.23, p = 0.010 |
| No Clear Preference (187) | 45 (24.06) | 118 (63.10) | 24 (12.83) | |
| Right Brain Preference (96) | 20 (20.83) | 63 (65.63) | 13 (13.54) | |

Those participants studying throughout the semester had significantly (t [N=400, df=360.916]= 2.330, p=0.020) higher academic score (62.94±12.91) than those studying a few weeks prior to examination (60.13±10.85).

**DISCUSSION:**

This cross-sectional study, aimed to investigate relationship between hemispheric brain preference and academic score in medical students. Out of 400 participants, 117 (29.25%) participants were found to have left brain preference, 187 students (46.75%) were found to have no clear preference and 96 students (24%) were found to have right brain preference. As this study shows diversity in brain preference among medical students in Lumbini Medical College, a good mix of various teaching learning methods such as preparing detailed notes, using charts, diagrams, graphs and audiovisual aids can be applied for higher achievement of the entire class.

Our findings contradict with the finding of the study by Keat TS et al. in medical students [10] which showed that 98 (58.3%) were left brained, 27 (16.1%) were whole brained and 43 (25.6%) were right brained. With regard to the level of hemispherical brain dominance in nursing students, more than half (61.6%) belonged to right brain dominance in the study by Mansour EA et al.[11] We have thought of two possibilities behind this inconsistency. Firstly, role of other extraneous factors notably economic status. Students from families with better economic status are at advantage while choosing to study medicine in a private medical college. Hence students might not have joined based on their free choice alone. Secondly, there may be no or weak association between hemispheric brain dominance and choice made by the students to study medical subjects.

Our study further showed that 15 (3.75%) students were left handed, 359 students (89.75%) were right handed and 26 students (6.50%) used both of their hands. Keat TS et al.[10] also reported that, 160 (95.2%) were right handed and 8 (5.4%) were left handed. Neither of the studies showed relationship between brain preference and handedness.

This study revealed a statistical significant difference in academic score of students with different hemispheric brain preference (Table 1). Students with left brain preference have the highest academic score (63.85±11.78) and those with no clear preference have the lowest (59.96±11.64). This study corresponds with study done by Mansour EA et al.[11] in nursing students who revealed a statistical significant difference between hemispherical brain dominance and the student's academic score in form of grade point average. However, this finding is inconsistent with those of Keat TS et al.[10], Singh P et al.[1], Kok I et al.[13], Ferrer FP et al.[22], Humera S et al.[23] and Ali RM et al.[24] who found that brain dominance has no effect on the student's academic score in Medicine, English and Mathematics. Behind these controversy, we suspect the role of other extraneous factors like study hours per day and study pattern. In our sample, participants with left hemispheric preference also spent more hours in study per day and they studied throughout the semester as well. Therefore, it is difficult to ascertain brain preference as the predictor of academic score independent of study hours and study pattern in this data.

To put together, our findings in the context of the past literature suggest that brain dominance may not be used as a guide to choose the career of the students. However, taking the diversity of the hemispheric brain preference of the medical students into consideration, role of a good mix

of teaching strategies to promote learning of the entire class cannot be denied. Also, knowledge of the hemispheric brain preference of the individual students may still be used to improve their learning.

There was no significant relation between hemispheric brain preference with handedness and study method which agrees with the findings of Keat TS.[10]

Though this study is a new study of this kind in this population, there are some limitations of our study. Firstly, despite a good face validity of OHBD scale, we could not find validation studies to show its construct validity in the literature. However, it has been used by education researchers for their study. Secondly, the result obtained from this study might not represent all medical students. Larger studies including medical students from different colleges will be more representative of all medical students.

## CONCLUSION:

Participants having no clear hemispheric brain preference were in majority followed by those with left hemispheric brain preference and then those with right hemispheric brain preference. Participants with left hemispheric brain preference were found to have the highest mean academic score but they also spent more time in study and also studied regularly throughout the semester. As this study shows diversity in brain preference among medical students, a good mix of various teaching learning methods may be applied for better learning of the entire class.

**Conflict of interest:**
The authors declare that no competing interest exists.

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