Strides Dev Med Educ. 2023 February; 20(1):3-7. doi 10.22062/sdme.2023.197960.1127

Brief report

A Practical Investigation of Brain-based Teaching Approach: Teaching English Speaking Skill to Nursing Students

Farzaneh Iranmanesh[1], Mehry Haddad Narafshan[2*], Mohammad Golshan[1]

[1]English Department, Maybod Branch, Islamic Azad University, Maybod, Iran.
[2]Department of Foreign Languages, Kerman Branch, Islamic Azad University, Kerman, Iran.

Received: 2022 November 15
Revised: 2023 February 05
Accepted: 2023 February 19
Published online: 2023 February 19

*Corresponding author:
Department of Foreign Languages, Kerman Branch, Islamic Azad University, Kerman, Iran.
Email: mehri.narafshan@yahoo.com

Citation:
Iranmanesh F, Haddad Narafshan M, Golshan M. A Practical Investigation of Brain-based Teaching Approach: Teaching English Speaking Skill to Nursing Students. Strides Dev Med Educ. 2023 February; 20(1):3-7.
doi:10.22062/sdme.2023.197960.1127

Abstract

Background: Brain-based teaching approach as one of the outcomes of the recent trend in neuroeducation employs brain-based learning insights and strategies to induce efficient and accelerated learning.

Objectives: This study aimed to investigate the effects of a brain-based language instruction model on nursing students' English-speaking skill.

Methods: In this quantitative study with quasi-experimental design and pre-test/post-test format, a model of brain-based instruction for 64 students of Nursing (50 females and 14 males) was incorporated into a required general English course at Islamic Azad University of Kerman, Iran during the academic year 2021-2022.

Results: Analysis of the independent sample t-tests and one-way ANCOVA indicated that the experimental group with intervention program of brain-based teaching approach considerably outperformed the control group in the pre-test and the posttest regarding speaking skill ($P<0.01$).

Conclusion: Tracing the natural learning process in the brain, adopting compatible teaching methods, and assigning pedagogical tasks greatly facilitated understanding of the learners, learning materials, and teaching methods as well as improved the educational outcomes.

Keywords: Brain-based Instruction, English Language Learning, Nursing Students, Speaking Skill

Background

Neuroeducation, one of the new trends in education, deals with how the brain naturally learns and maximizes the instruction and learning qualities. Over the last two decades, brain research field has undergone a shift in paradigm from focusing on the regional function and mental processing of the distinct brain regions to focusing on the interrelationship among brain areas known as network connectivity. Thus, a holistic view that even a simple task is the outcome of the activation of overlapping sets of brain areas has been taken by scholars and neurologists such as Ganis, Thompson (1), Sporns, Tononi (2), and Friston (3). Similarly, connectome theory – the theoretical framework of this study – initiated by Sporns, Tononi (2) and, later, by the National Institute of Health (2016) attempts to explain the existing relationship among human cognitive activities based on the brain's neural, anatomical, and functional connections.

Another brain-based learning (BBL) theory is Adaptability which focuses on how the brain undergoes change and re-organization caused by learning new abilities, skills, and experiences as well as other environmental factors. Learning second language (L2) skills is no exception. Recent studies on second language acquisition have suggested that L2 experiences can change the brain structures and functional networks (4-6), and that language is governed by the coordinated activity of a variety of brain regions (7).

As globalization accelerates, it becomes more critical for nursing students to communicate with speakers of other languages. English as a foreign language (EFL) has been widely used over the past decades and, as the result, the learners' communicative competence has become the focus of linguistic pedagogical interest worldwide (8). Presently, English is an international language of medicine. It is also expanding as an international communication and educational tool. The literature highlights the importance of communication skills among nursing practitioners, since an effective nurse-patient communication is a crucial aspect of quality patient care (9). In this respect, neuroeducation as an incipient trend in the history of education has not received sufficient research attention. Similar to computer-assisted learning which was once developed from advances in computer science, neuroeducation should be developed, so that education can benefit from the medical and technological advances. Like any other academic learners, nursing students need international communication in addition to keeping themselves informed of the advances in medicine and health care. Given that English is the global language of communication and science, their general English courses which are limited to reading texts and passages have little to do with improving their communication skills in L2 as the major goal of EFL speaking. Hence the developed brain-based model of instruction was implemented to make the general English course practically communicative and productive for the nursing students. In other words, the instructional material and method was oriented toward brain-based learning in order to investigate its effects on English speaking skill of the nursing students.

Objectives

This study aimed to investigate the effects of a brain-based language instruction model on nursing students' English-speaking skill.

Methods

To test the hypotheses underpinning this quantitative quasi-experimental research, 64 nursing students (50 females & 14 males) aged 19-26 years and doing a required general English course at the foreign languages department of the Islamic Azad University of Kerman, Iran in the academic year 2021-2022 were investigated. A convenience sampling was adopted in this study where two general English classes were selected and randomly assigned to control and experimental groups. Since the distribution of male and female students was not equal, gender differences were not studied in this research. None of the participants had lived in an English-speaking country. To ensure homogeneity of the participants in terms of the English language proficiency level, a criterion-referenced measure by Longman ELT was used to evaluate 76 students, as a result of which 64 participants (32 in each class) were included in the study after excluding 25 students of either lower or upper level of English proficiency.

Speaking pre-test and post-test were conducted to measure the degree of improvement in English-speaking skill of the learners from both groups at the beginning and final sessions. Students were assessed individually by a 15-min interview using Speak Now Testing Program:

- Interview questions (i.e., a list of teacher-led interview questions)
- Role-play cards (i.e., cards for students to role-play situations in pairs)

A standardized framework adapted from Cambridge speaking assessment rubrics was used to ensure the implementation of the same procedure in both classes. The assessment measured the participants' speaking knowledge (i.e., grammatical resource, lexical resource, and pronunciation) and speaking skills (i.e., discourse management, interactive communication, and global achievement).

The textbook "Speak Now 4" was selected as the course book to deliver the content of instruction during 14 sessions, each of which lasted 90 minutes. The conventional approach was implemented only through the activities included in the textbook and course syllabus for the control group. On the other hand, the brain-based model of instruction was used as the treatment for the experimental group.

The brain-based model of instruction was developed when the structural and functional brain regions, which are involved in language learning and cognitive functions, were explored and classified under the major activities and functions of the three large-scale brain networks (i.e., Salience, Default mode, Central executive). Figure 1 shows the connections among three networks and their function and active process. Instruction process and class activities were developed for the experimental group based on the unique features of brain function that are conducive to foreign language speaking ability. Consequently, the course book instructional material and class activities were orientated toward brain-based principles and activation of the three large-scale networks. As for the experimental group and during the process of teaching speaking by considering this framework, the instructor ensured presenting, practicing, and assessing the content of the course book, which all took place in the sequence of: 1) encouraging interaction (SN), 2) creating or inferring experience (SN), particularly good experience, 3) inducing positive emotions (CEN) accordingly, and 4) reinforcing memory (DMN) and encouraging learners to interact effectively and have perseverance. These activities are manifestations of the underlying interdependent brain network functions.

All these classroom activities have been designed to facilitate activation and cooperation of the three large-scale networks as is the case in normal brain development since birth. The proposed hypothesis is a bottom-up process of tracing and bolstering neural connections and pathways in order for enhancing learning.

Data were analyzed by SPSS software (version 26) and using mean, standard deviation, independent-sample t-test, One-Way ANCOVA, and effect sizes to answer the research question (i.e., the objective of the study). The effect sizes were categorized as low (d=0.2), medium (d=0.5), and high (d=0.8).

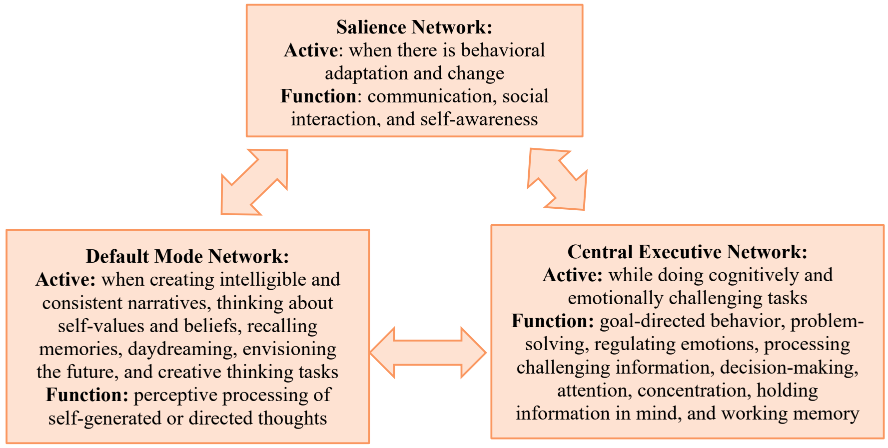

Figure 1. The Triple Networks' Areas of Activity and Functions

Results

According to the results, implementing brain-based English language instruction had no effect on speaking skill of the nursing students. Levene's test and normality checks were performed, and the assumptions were met. Homogeneity of variance, linear relationship between the dependent variable and covariate ($P > 0.50$), and homogeneity of regression slopes were observed ($P > 0.50$). Therefore, the ANCOVA test was performed to evaluate the speaking development variable.

As shown in Table 1, there was a significant difference between experimental group and control group regarding the mean scores achieved in the post-test speaking development. Therefore, implementing brain-based instruction significantly contributed to improving the participants' speaking skill ($P < 0.01$). The estimated partial Eta Squared was (partial $\eta^2 = 0.62$), which showed a good effect. Therefore, the null hypothesis was rejected and, according to the estimated marginal means, the experimental group was found to perform more successfully than the control group regarding the improvement of speaking skill (Table 1).

Moreover, analysis of the independent sample t-test for the pre-tests in both groups found no significant difference in their command of speaking. However, the results confirmed a significant difference in the mean scores for speaking development in the post-test of both groups with an increase in the mean score of the experimental group (Table 2). The effect size was 1.32 and the *r* was 0.55.

Discussion

Analyzing the brain's distributed functional and structural areas responsible for language-related activities based on the triple large-scale networks helped develop an instructional brain model which was used in this study to test practicality. The effect of this instructional model on the English-speaking skill of nursing students was investigated, and it was revealed that the experimental group outperformed the control group with a bigger effect size. The results of the speaking test demonstrated that the students in the experimental group performed better in terms of initiating a conversation since the treatment was based on cultivating interaction as the opening phase. It was detected that they were able to maintain and manage the flow of speaking more effectively as long as they benefited from the treatment involving creation of narratives and self-generated perceptive as well as expressing directed thoughts. When students from experimental group were asked to illustrate examples and support their viewpoints, they were found more prepared and more expressive than those from the control group. Moreover, the experimental group outperformed the control group regarding vocabulary knowledge and sentence structures with less grammatical and pronunciation errors.

This may have been attributed to the efficiency of the brain-based model. This model of instruction entails a cycle of cultivating interaction, generating experience, provoking positive emotions and, accordingly, reinforcing memory which motivates the learners to interact more effectively and continuously. Instructional and class activities practiced in this cycle framework are projections of the brain's triple large scale networks function in a triggered systematic way.

Table 1. The Result of Covariance Analysis and Estimated Marginal Means (Speaking Development)

	Source	Sum of Squares	df	Mean Square	F	P-Value	partial η^2
Covariance Analysis	Pre-test	65.650	1	65.650	34.003	0.000	
	Group	80.466	1	80.466	41.677	0.000	0.62
	Error	117.772	61	1.931			
	Corrected Total	259.984	63				
Estimated Marginal Means	Group	Estimated Marginal Mean	Std. Error				
	Control	15.75	0.246				
	Experimental	18.02	0.246				

df: Degree of freedom

Table 2. Independent Sample T-Test of Research Variable

Variable	Time	Group	N	Mean(SD)	T-Test	df	P-Value	Mean Difference	95% CI of the Difference	
									Lower	Upper
Speaking Development	Pre-Test	Control	32	13.96(1.42)	0.22	61.98	0.830	0.02	-0.72	0.78
		Experimental	32	13.94(1.45)						
	Post-Test	Control	32	15.75(2.16)	-5.09	46.77	0.000	-2.27	-3.11	-1.42
		Experimental	32	18.02(1.13)						

SD: Standard deviation; df: Degree of freedom; CI: Confidence interval

In other words, the relevance of implementing this model lies in the fact that it follows the natural learning process of the brain through establishing interaction and creating experience, creating positive emotion, and reinforcing the memory, which determine brain development since childhood. This finding was in line with the connectome theory which emphasizes the immerging functions of the brain due to conjoined actions of dispersed areas in the brain rather than the separate actions of distinct areas; however, it was inconsistent with brain modularity which suggests that single brain areas operate in isolation to process and produce cognitive functions. That is why simultaneous conjoint actions of the triple networks are emphasized and practiced in this model of instruction.

Our study results regarding the defined components for the brain-based teaching approach (BBTA), as developed in the model, were consistent with the findings from the study by Jensen (10) regarding two essential features for brain development; adaptability, which reinforces the fact that environmental factors such as experiences, actions, and interactions, causes changes in the brain and the integration which supports how well the structures of the brain cooperate and compete to store and process information. Occurrence of these changes, which are initiated by activation of the learners' perception, sensory-motor integration, joint attention, sharing of experience, and social involvement, was also confirmed by Caplan (11) who examined the association of epilepsy, language, and aspects of social behavior. Caplan underscored the importance of developing both social and language skills for intrapersonal and interpersonal functioning and quality of life through indicating the association and connectivity of the biological and psychological underpinnings of language and social skills in adults and children. Regarding the social brain, eliciting emotion, and developing thinking skills as effective determinants of the brain-based language learning instruction, the empirical studies corroborated the original findings by Hileman (12) and Tate (13) who offered recommendation for engaging the brain and implementing strategies that potentiate brain-based learning.

As for the implementation of principles and strategies of brain-based teaching including brain activation, novelty, challenge, meaning-making, interactive feedback, and collaboration developed in classroom activities, the positive outcome was similar to the findings reported in the study by Tafti and Kadkhodaie (14) who investigated the positive effects of these principles and strategies on life skills including self-management, empathy, effective communication, awareness, stress management, decision making, and critical thinking as learning skills.

Finally, our study result regarding the overall speaking achievement of the experimental group was remarkably consistent with the findings by Immordino-Yang and Darling-Hammond (15) who revealed that conjoined brain functions and social relationships, emotional experience, as well as cognitive resources were required for brain development and taking advantage of learning opportunities. Despite the existence of a great potential for applying cognitive neuroscience findings to education, limited experimental studies have been conducted to investigate the application of brain-based principles in classrooms. Implementing this brain-based model of instruction, which requires more practical investigation before its application in the educational system, may have positively contributed to not only general English courses but also to nursing field of study.

Conclusion

Brain-based compatible instruction, which is at the forefront of education presently, led to the emergence of neuroeducation. This study aimed to examine the connectome theory which concentrates on brain network connectivity. Given that different brain areas do not function in isolation and that the brain has a proven ability to perform multiple simultaneous functions, the L2 speaking skill was selected to help put a theory into practice. This selection was motivated by: first, completion of the speaking process requires multiple functions of the brain; and second, L2 speaking ability is considered a tedious skill to achieve among learners, including nursing students. Compatible activities, techniques, and strategies used in this experiment for simultaneous activation of the three large-scale networks were found to successfully help the learners improve their English-speaking skill.

Acknowledgements: The authors would like to thank all scholars of neurological studies who contributed to pedagogical investigations as well as all students who participated in this study.

Conflict of interests: The authors declare that they have no conflict of interests.

Ethical approval: This study was approved by the Islamic Azad University of Kerman branch with the ethical code No. 1400.17 948.

Funding/Support: This study received no funding support.

References

1. Ganis G, Thompson WL, Kosslyn SM. Brain areas underlying visual mental imagery and visual perception: an fMRI study. Brain Res Cogn Brain Res. 2004 Jul;20(2):226-41. doi: 10.1016/j.cogbrainres.2004.02.012. [PMID: 15183394]
2. Sporns O, Tononi G, Kötter R. The human connectome: a structural description of the human brain. PLoS Comput Biol. 2005 Sep;1(4):e42. doi: 10.1371/journal.pcbi.0010042. [PMID: 16201007] [PMCID: PMC1239902]
3. Friston KJ. Functional and effective connectivity: a review. Brain Connect. 2011;1(1):13-36. doi: 10.1089/brain.2011.0008. [PMID: 22432952]
4. Bubbico G, Chiacchiaretta P, Parenti M, Di Marco M, Panara V, Sepede G, et al. Effects of second language learning on the plastic aging brain: functional connectivity, cognitive decline, and reorganization. Front Neurosci. 2019 May 15;13:423. doi: 10.3389/fnins.2019.00423. [PMID: 31156360] [PMCID: PMC6529595]
5. Luk G, Pliatsikas C, Rossi E. Brain changes associated with language development and learning: A primer on methodology and applications. System. 2020;89:102209. doi: 10.1016/j.system.2020.102209.
6. Sousa DA. How the brain learns. 5th ed. California, USA: Corwin Press; 2016.
7. Bressler SL, Menon V. Large-scale brain networks in cognition: emerging methods and principles. Trends Cogn Sci. 2010 Jun;14(6):277-90. doi: 10.1016/j.tics.2010.04.004. [PMID: 20493761]
8. Mahmoodi H, Narafshan MH. Identity types and learners' attitudes in language learning: Voices from students of medical sciences. Research and Development in Medical Education. 2020;9(1):17. doi: 10.34172/rdme.2020.017.
9. Bennett K, Lyons Z. Communication skills in medical education: an integrated approach. Education Research and Perspectives. 2011;38(2):45-56.
10. Jensen E. Teaching with the brain in mind. 2nd ed. Alexandria, Virginia USA: Association for Supervision and Curriculum Development; 2005.
11. Caplan R. Epilepsy, language, and social skills. Brain Lang. 2019 Jun;193:18-30. doi: 10.1016/j.bandl.2017.08.007. [PMID: 28987707]
12. Hileman S. Motivating students using brain-based teaching strategies. Agricultural Education Magazine. 2006;78(4):18-21.
13. Tate ML. Worksheets don't grow dendrites. Instructional Leader. 2013;26(2):1-3.
14. Tafti MA, Kadkhodaie MS. The effects of brain-based training on the learning and retention of life skills in adolescents. Int J Behav Sci. 2016;10(4):140-4.
15. Immordino-Yang MH, Darling-Hammond L, Krone C. The Brain Basis for Integrated Social, Emotional, and Academic Development: How Emotions and Social Relationships Drive Learning. Washington, D.C., USA: The Aspen Institute; 2018.