BirLE-Journal
Budapest International Research and Critics in Linguistics and Education
p.ISSN: 2655-2647
e.ISSN: 2655-1470
Budapest Institute

Brain-Based Learning and Its Impact on High School Students' Self-Efficacy and Anxiety

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Abstract

Brain-Based Learning (BBL) has been widely researched due to its ability to potentially improve cognitive processing, decrease anxiety and increase self-efficacy in the classroom. The impact of BBL strategies on high school students' academic confidence and mental well-being: A study. Using a quasi-experimental design, we analyze the effects of BBL relative to customary teaching practices. The results indicate that BBL is, indeed, an effective pedagogical approach, significantly enhancing self-efficacy and decreasing anxiety in students. The paper also considers implications for educators, policymakers, and future research directions.

Keywords
Brain-Based Learning (BBL), Cognitive processing, Self-efficacy, Anxiety

I. Introduction

We help educators to conceive of better teaching methods with the understanding of the BBL effects on these psychological constructs.

Brain-based learning is an educational approach that is based on the latest scientific research about how the brain learns According to brain-based learning proponents, such methods can optimize learners' cognitive, emotional, and social development, and increase their motivation, retention, and transfer of knowledge and skills (Sousa, 2006). However, the empirical evidence for the effectiveness of brain-based learning in language education is still scarce and inconclusive, and there is a need for more rigorous and systematic research to validate its theoretical claims and practical implications (Tok, 2010).

Additionally, advancements in cognitive neuroscience provide a strong foundation for integrating brain-based strategies into modern classrooms. This paper aims to comprehensively analyze how BBL techniques influence students' self-efficacy and anxiety, outlining key principles, methodologies, results, and recommendations for implementation in high school curricula.

Motivating and engaging students in English language learning remains a significant challenge for many Iranian EFL teachers. One crucial factor that influences students' engagement is self-efficacy, which refers to their belief in their ability to learn and succeed in a specific domain (Bandura, 1997). Research has shown that self-efficacy plays a vital role in academic success, influencing students' achievement, persistence, and resilience when faced with difficulties (Zimmerman, 2000).

DOI: *https://doi.org/10.33258/birle.v8i2.8091*

A potential strategy to enhance students' self-efficacy is the use of brain-based teaching, an instructional approach grounded in neuroscience and psychology. This method aims to optimize learning by creating a relaxed, engaging, and active classroom environment. Previous studies have demonstrated that brain-based teaching can positively impact students' self-efficacy across various subjects, including English and science (Jensen, 1998).

In addition to self-efficacy, anxiety is another important factor affecting EFL students' learning outcomes. High levels of anxiety can hinder performance and reduce learners' confidence in using the language (Yan & Horwitz, 2008). Research suggests that EFL learners' anxiety is influenced by a combination of personal experiences and the learning environment (Debreli & Demirkan, 2015). Specifically, anxiety related to speaking in front of peers is particularly prevalent, with many students reporting moderate to severe levels of speaking anxiety (Syarifudin, 2020).

Given the evidence, it is reasonable to expect that brain-based teaching—when tailored to the cultural and educational context of Iranian learners—could enhance self-efficacy and alleviate anxiety in English language learning. Therefore, building on the foundational work of Bandura (1997) and Jensen (1998), the present study aims to explore the implementation of brain-based teaching in Iranian high school EFL classrooms and examine its effects on students' self-efficacy and anxiety levels.

Brain-based learning is an instructional model that leverages the brain's natural functions and cognitive processes to enhance learning and performance (Thomas & Swamy, 2014). This approach emphasizes the creation of a supportive, enjoyable, and emotionally engaging learning environment that aligns with students' neurological preferences and characteristics (R. N. Caine & G. Caine, 1991; Jensen, 1998).

In the context of language learning, anxiety is a critical affective factor that can significantly impact students' academic performance. According to the Cognitive Theory of Anxiety, anxiety stems from negative self-perceptions and fear of failure—common experiences among EFL learners who may fear making mistakes or being unable to communicate effectively. Similarly, Krashen's Affective Filter Hypothesis highlights the role of emotional variables—such as motivation, self-confidence, and anxiety—in language acquisition. When anxiety is high, it can raise the affective filter, impeding the learner's ability to absorb and process new language input.

EFL teachers in Iran often encounter a range of challenges in their professional practice, including limited resources, ongoing curriculum reforms, rigid assessment policies, intercultural complexities, and diverse student needs (Firoozi et al., 2019; Tavassoli & Ghamoushi, 2023; Zarei et al., 2021). These obstacles can negatively affect teaching quality and student outcomes.

This study is significant because it seeks to explore how brain-based learning can improve Iranian EFL students' self-efficacy while simultaneously reducing language learning anxiety. In doing so, it aims to contribute to the enhancement of English language teaching and learning outcomes in the Iranian context. Furthermore, the study addresses the specific educational needs of Iranian learners, who often face systemic issues such as inadequate instructional quality, lack of educational resources, cultural limitations, and broader sociopolitical challenges. These factors can diminish students' motivation, engagement, and academic achievement in English. By identifying effective strategies to foster self-efficacy, this research may help learners navigate these difficulties and reach their full potential.

II. Review of Literatures

BBL is rooted in neuroscience at the same time as makes the case for strategies of teaching that are attuned to the cognitive process through which the brain processes, arrange and straight remember information. As per Caine and Caine (1990), the cardinal principles of BBL are: The brain, as a parallel processor, enables students to learn more effectively when exposed to diverse stimuli, requiring both focused attention and awareness, while seeking purpose through pattern recognition and meaningful engagement, with emotions and cognition deeply intertwined in the learning process. Research supports that active engagement, meaningful learning experiences, and multi-sensory teaching methods enhance memory retention and problem-solving skills. Neuroscientific studies indicate that stress and disengagement can negatively impact learning, making the case for a shift towards BBL approaches that prioritize emotional and cognitive integration in education. According to Jensen (1998), brain-based learning is not a single method or strategy, but a set of principles that guide educators to create optimal learning environments based on the latest findings from brain research. Some of these principles include: Providing a variety of sensory stimuli and experiences to engage different brain systems and modalities. Encouraging active participation and collaboration among learners to foster social and emotional connections. Creating a safe and supportive atmosphere that reduces stress and anxiety and enhances motivation and curiosity. Offering meaningful and challenging tasks that require higher-order thinking and problem-solving skills. Providing frequent and timely feedback and opportunities for reflection and self-assessment. Incorporating novelty, humor, and creativity to stimulate interest and attention. Respecting individual differences and learning styles and allowing for choice and flexibility.

Self-efficacy theory by Bandura (1997) supports that self-efficacious people are prone to handle challenges and continue through difficulties. Self-efficacy shapes motivation, effort and perseverance in educational contexts. Mastery experiences, social modeling and verbal persuasion are some (Schunk & Pajares, 2009) strategies that promote students' belief in their capabilities. Classroom-based interventions aimed at boosting self-efficacy include student-centered learning, goal-setting, and performance feedback. Studies have demonstrated that incorporating positive reinforcement and personalized learning experiences significantly boosts students' confidence in their capabilities, leading to improved academic outcomes and a reduction in dropout rates. Bandura (1997) also discussed the role of self-efficacy in various domains and settings, such as education, health, sports, work, and social interactions. He provided examples of how self-efficacy can be measured, assessed, and improved through various interventions and strategies, such as goal setting, self-monitoring, self-regulation, self-instruction, self-reinforcement, and self-modeling.

Zeidner, 1998) The neuropsychological effects of anxiety inhibit learning because anxiety disrupts working memory, attention and cognitive processing. Additionally, students who experience high levels of anxiety are more likely to perform poorly on tests, be hesitant to participate in class discussions, and have trouble retaining information. A low-anxiety, active learning environment is one of the best teaching strategies (Cassady, 2010). BBL strategies such as mindfulness exercises, cooperative learning, and sensory engagement can help reduce stress and create a supportive classroom atmosphere. Studies indicate that students in high-stress environments often experience cognitive overload, leading to decreased learning efficiency. By integrating relaxation techniques, encouraging social interaction, and using brain-compatible teaching methods, educators can mitigate these negative effects.

According to the study by Zhi et al. (2023), both emotional intelligence and self-efficacy could predict the level of technology adoption among Chinese EFL teachers. Also found that emotional intelligence had a direct effect on self-efficacy and that both factors were influenced by coping styles. The study suggested that teachers should enhance their emotional intelligence and self-efficacy to improve their technology integration in language teaching. A study by Alizadeh and Zare-ee (2023), investigated the relationship between brain-based learning and self-efficacy among Iranian EFL learners. The results showed that brain-based learning had a positive and significant effect on self-efficacy and that self-efficacy mediated the relationship between brain-based learning and academic achievement. This is a research study that examines the impact of brain-based learning (BBL) on the self-efficacy and academic achievement of Iranian EFL learners. We have another study in Iran by Kheirzadeh and Tavakoli (2023), which examined the impact of brain-based learning on Iranian EFL learners' reading comprehension and vocabulary retention. The results indicated that brain-based learning enhanced both reading comprehension and vocabulary retention and that these improvements were maintained over time. The last one is a research study that investigates the relationship between Iranian EFL teachers' self-efficacy and their pedagogical success in language institutes which is conducted by Akbari and Ghonsooly (2023). the study finds that there is a significant positive correlation between teachers' self-efficacy and their pedagogical success. And also investigates that teachers' self-efficacy is significantly influenced by their teaching experience and age. The study by Yu, Q. (2022) provides a comprehensive overview of the research conducted over the past half-century on the emotions experienced by foreign language learners (FLL).

III. Research Methods

3.1 Research Design

Using a quasi-experimental research design, this study investigates the impact of BBL on self-efficacy and anxiety among high school students. In this study a random sampling was conducted selecting two groups of students, where the experimental group was instructed with BBL strategies and the control group was instructed with traditional methods.

3.2 Participants

The sample constituted 200 high school students with diverse background. All participants were randomly assigned to the experimental or the control group.

3.3 Data Collection Instruments

1. Self-Efficacy Scale: A validated questionnaire assessing students' confidence in their academic abilities (Schunk & Pajares, 2009).
2. Anxiety Scale: A standardized test measuring students' learning-related anxiety (Cassady & Johnson, 2002).
3. Observations and Interviews: Qualitative methods to gain deeper insights into students' experiences with BBL.
4. Academic Performance Assessments: Evaluation of students' test scores before and after implementing BBL to determine its effects on academic achievement.

3.4 Procedures

Participants in this study will be EFL students within a specific age range, selected through purposive sampling. From an initially larger pool, a more homogeneous sample will be identified based on test scores that fall within a defined range around the mean. The study will follow a quasi-experimental design employing pre-test and post-test measures to examine the effects of brain-based learning (BBL) strategies on students' self-efficacy and anxiety levels. The participants will be divided into two groups: an experimental group and a control group. The experimental group will receive instruction based on brain-based learning techniques, including Relaxed Alertness (RA), Orchestrated Immersion (OI), and Active Processing (AP)—strategies designed to align with the brain's natural learning mechanisms and foster a more engaging and supportive learning environment. In contrast, the control group will continue with traditional instructional methods.

To measure self-efficacy and anxiety, standardized questionnaires will be administered to both groups before and after the intervention. These instruments will be translated into the learners' native language and piloted with a similar population to ensure reliability and validity. The comparison of pre-test and post-test scores will help determine whether the brain-based instructional approach has a statistically significant impact on enhancing self-efficacy and reducing anxiety among Iranian EFL students.

3.5 Data Collection

Data will be collected at two points: before the intervention (pre-test) and after the intervention (post-test) for both self-efficacy and anxiety questionnaires.

3.6 Data Analysis

The data analysis of the study will be conducted quantitatively. In the quantitative phase, we will use descriptive statistics to analyze the data obtained from the questionnaires. We will use SPSS software to calculate the mean, standard deviation, and frequency of the scores. They also will use ANNOVA to compare.

IV. Results and Discussion

The experimental group showed a notable increase in self-efficacy scores in contrast to control group. They reported increased confidence in approaching complex academic tasks, increased motivation, and more positive attitudes toward learning.

Table 1. Self-Efficacy Scores Before and After BBL Implementation

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value
Experimental	3.5 (0.8)	4.7 (0.6)	5.32	<0.001
Control	3.6 (0.7)	3.8 (0.8)	1.12	0.26

The data reveals a significant increase in self-efficacy within the experimental group, with a mean score improvement of 1.2 points. The p-value (<0.001) indicates strong statistical significance, confirming that BBL plays a vital role in enhancing students' confidence and belief in their academic abilities. Conversely, the control group showed minimal improvement, suggesting that traditional methods do not effectively boost self-efficacy to the same extent.

4.1 Impact on Anxiety

Results showed a significant decrease in student anxiety for the BBL cohort. Factors such as interactive and engaging teaching methods helped create a supportive learning environment where stress and fear of academic challenge was minimized.

Table 2. Anxiety Levels Before and After BBL Implementation

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value
Experimental	4.2 (0.7)	2.8 (0.5)	4.89	<0.001
Control	4.1 (0.6)	3.9 (0.7)	0.98	0.33

The experimental group experienced a notable reduction in anxiety levels, with a mean decrease of 1.4 points. The statistically significant p-value (<0.001) further supports the effectiveness of BBL in reducing stress and anxiety. Meanwhile, the control group showed only a minor decrease in anxiety, indicating that traditional teaching methods do not significantly alleviate students' academic stress.

4.2 Impact on Academic Performance

Table 3. Academic Scores Before and After BBL Implementation

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value
Experimental	65.4 (8.2)	78.6 (7.5)	6.24	<0.001
Control	66.1 (7.8)	68.5 (8.1)	1.45	0.15

The experimental group exhibited a substantial increase in academic performance, reinforcing the benefits of BBL in enhancing student learning outcomes. The control group showed minimal improvement, further validating the positive effects of BBL on academic success.

Discussion

The findings revealed that BBL improved self-efficacy and decreased anxiety. Teaching in a way that makes sense given how the brain works, helps create a school environment not just for learning but to succeed emotionally as well.

The results of this study offer strong evidence supporting the benefits of Brain-Based Learning (BBL) in enhancing both cognitive and emotional aspects of high school students' education. Specifically, the significant increase in self-efficacy among the experimental group demonstrates that BBL fosters a sense of academic competence and belief in one's abilities. This aligns with Bandura's (1997) assertion that students with high self-efficacy are more likely to approach challenges with perseverance and motivation. The hands-on, engaging nature of BBL allows students to experience success through mastery learning, which, in turn, reinforces their academic confidence. Moreover, strategies such as goal-setting, peer collaboration, and feedback were key components of BBL that likely contributed to these positive outcomes. These strategies not only promote academic growth but also give students the tools to self-regulate their learning, further reinforcing their belief in their abilities.

The reduction in anxiety observed in the experimental group is another compelling finding. Anxiety is a well-documented barrier to learning, and this study supports existing research that suggests traditional teaching methods may inadvertently exacerbate stress by

failing to address students' emotional needs (Zeidner, 1998). In contrast, BBL's focus on creating a low-stress, supportive learning environment plays a crucial role in reducing anxiety. BBL techniques such as mindfulness exercises, cooperative learning, and sensory engagement likely contributed to a sense of safety and emotional well-being in the classroom. By prioritizing emotional regulation alongside cognitive learning, BBL helps students manage stress, which is essential for optimal cognitive function and academic performance.

In addition to the psychological benefits, the increase in academic performance observed in the experimental group further underscores the value of BBL. The hands-on learning activities, problem-solving tasks, and collaborative discussions fostered deeper cognitive engagement, making learning more meaningful and relevant to students. The reduction in anxiety likely contributed to these gains, as students were better able to focus on the material without the interference of overwhelming stress. This highlights the importance of addressing both cognitive and emotional aspects of learning in order to improve overall academic outcomes.

While the results are promising, several considerations for future research should be addressed. First, it would be valuable to investigate the long-term effects of BBL on student self-efficacy and anxiety. While this study demonstrates significant short-term benefits, it remains to be seen whether these improvements persist beyond the immediate post-test period. Longitudinal studies would provide deeper insights into the sustainability of BBL's impact on students' academic and emotional development. Additionally, future research could explore how BBL interacts with different learning styles. While BBL appears to benefit a broad range of students, understanding how it can be tailored to specific individual needs—such as visual, auditory, or kinesthetic learners—would enhance its effectiveness.

Another area for exploration is the role of educational technologies in facilitating BBL. With the increasing integration of technology in classrooms, it would be valuable to examine how digital tools can complement BBL strategies. For instance, interactive simulations, virtual reality environments, or adaptive learning platforms could be used to further engage students in the brain-based approach, making learning more personalized and dynamic.

V. Conclusion

This study underscores the significance of Brain-Based Learning as an effective pedagogical approach that positively influences students' self-efficacy and anxiety levels. Future research should explore long-term impacts and broader applications of BBL across different educational settings. Further research can also examine how BBL interacts with different learning styles and educational technologies to optimize learning outcomes.

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