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Regular Article

Enhancing EFL Writing and Self-Management Through Brain-Based Learning: An Intervention Study in Egyptian Preparatory Schools

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Abstract:

This study investigated the effectiveness of brain-based learning (BBL) on enhancing EFL writing skills and self-management in third-year preparatory school students in Egypt. A quasi-experimental design compared a treatment group (n=35) receiving BBL instruction to a control group (n=35) with traditional methods. Data was collected using pre- and post-tests, employing an EFL writing skills checklist assessing content, organization, mechanics, and a self-management scale measuring planning and self-regulation. Statistical analysis revealed that the BBL group demonstrated significant improvements in both EFL writing proficiency and self-management abilities compared to the control group, as evidenced by independent samples t-tests. Specifically, the BBL group showed substantial gains in writing clarity, logical content presentation, and the use of supporting details. Furthermore, their self-management scores significantly increased, indicating enhanced goal-setting and self-monitoring skills. These findings suggest that BBL strategies, emphasizing active learning, meaningful connections, emotional engagement, and collaboration, are a potent approach to improve EFL writing and foster crucial self-regulatory skills in young learners. This research strengthens the evidence

base for integrating BBL principles into EFL pedagogy within similar educational contexts.

Keywords: Brain-Based Learning (BBL), EFL Writing Skills, Self-Management, Preparatory School Students, Egypt, Instructional Intervention, Quasi-Experimental Design

Introduction:

Proficiency in English as a Foreign Language (EFL) is increasingly crucial in a globalized world, and writing skills form a cornerstone of effective communication. However, many EFL learners, particularly at the preparatory school level, struggle with various aspects of writing, including generating ideas, organizing thoughts coherently, using appropriate grammar and vocabulary, and managing the writing process effectively (Al-Maliki, 2021; Al-Halayqa, 2018). Traditional EFL writing instruction often emphasizes rote memorization and grammar drills, which may not fully engage students' cognitive processes or foster deep understanding and self-regulation (Abdullah, 2015).

The burgeoning field of educational neuroscience has fueled a significant shift towards brain-based learning (BBL) approaches in recent years. BBL advocates for the design of learning environments and pedagogical strategies that are congruent with the brain's inherent learning mechanisms (Jensen, 2008; Caine & Caine, 2006). Central to BBL are several core principles. **Active engagement** is paramount, emphasizing that learning is optimized when students are actively involved in the process, rather than passively receiving information. This aligns with constructivist learning theories and has been shown to improve retention and understanding (Michael, 2006). **Meaningful connections** are also crucial; the brain more readily acquires and retains new information when it is linked to existing knowledge and experiences (Bransford et al., 2000). This principle underscores the importance of activating prior knowledge and making learning relevant to students' lives. **Emotional engagement** is increasingly recognized as a critical factor, as emotions profoundly influence motivation, attention, and memory consolidation (Immordino-Yang & Damasio, 2007; Tyng et al., 2017). Creating a positive and supportive learning environment can therefore enhance learning outcomes.

Furthermore, BBL recognizes the inherently **social** nature of learning; collaboration and interaction with peers facilitate understanding and knowledge construction (Vygotsky, 1978; Johnson & Johnson, 2009). The BBL and learning theory principles are also applied in writing. Writing tasks are enhanced through the **Pattern recognition**, that occurs in the brain, and the use of BBL facilitates the activation of these different areas (Sousa, D. A. (2017). How the brain learns to read. Corwin press.) Finally, research supports the integration of **multi-sensory learning** experiences, indicating that engaging multiple senses can enhance memory encoding and retrieval (Shams & Seitz, 2008; Ghazanfar & Schroeder 2006). Combining, for instance, visual, auditory, and kinesthetic activities can create richer, more durable learning experiences.While BBL has shown promise in various educational contexts (Duman, 2010; Willis, 2008), its specific

application to EFL writing instruction, particularly in the context of Egyptian preparatory schools, requires further investigation.

Research Gaps:

Despite the theoretical appeal of BBL and some evidence of its effectiveness, several research gaps remain:

1. **Limited Empirical Evidence in EFL Writing:** While some studies have explored BBL in EFL contexts (e.g., Yagcioglu, 2014), more research is needed to specifically examine its impact on EFL writing skills, particularly in comparison to traditional instructional methods.
2. **Focus on Self-Management:** The connection between BBL and self-management skills in EFL learners, especially in the context of writing, is under-explored. Self-management, including planning, monitoring, and evaluating one's learning, is critical for successful writing (Maher, 2008; Al-Thaqafi, 2005).
3. **Contextual Relevance:** Most BBL research has been conducted in Western contexts. It is essential to investigate the applicability and effectiveness of BBL in diverse cultural and educational settings, such as Egyptian preparatory schools.
4. **Specificity for intermediate School:** The document presented provides insufficient information and recommendations to address the needs of this age group.

Objectives of the Study:

This study aims to address these gaps by investigating the following objectives:

1. To determine the effect of a BBL-based instructional course on the EFL writing skills of third-year preparatory school students in Egypt.
2. To assess the impact of the BBL-based instructional course on the self-management skills of these students.
3. To compare the effectiveness of the BBL approach with traditional EFL writing instruction.

Research Questions:

This study seeks to answer the following research questions:

1. Is there a statistically significant difference in EFL writing skills between students who receive BBL-based instruction and those who receive traditional instruction?
2. Is there a statistically significant improvement in EFL writing skills within the BBL treatment group from pre-test to post-test?
3. Is there a statistically significant difference in self-management skills between students who receive BBL-based instruction and those who receive traditional instruction?
4. What's the level of the impact of Brain Based Learning on self-managment skills?

Hypotheses

This study tested the following hypotheses:

1. H1 (Group Equivalence - Null Hypothesis): There is no statistically significant difference in EFL writing skills between the treatment group and the control group at baseline (pre-test).
2. H2 (Between-Groups Difference - Alternative Hypothesis): There is a statistically significant difference in EFL writing skills between the treatment group (receiving brain-based learning instruction) and the control group (receiving traditional instruction) at post-test, with the treatment group demonstrating significantly higher scores.
3. H3 (Within-Group Improvement - Alternative Hypothesis): There is a statistically significant improvement in EFL writing skills within the treatment group from pre-test to post-test.
4. H4 (Self-managment effect - Alternative Hypothesis): There is a statistically significant difference in self-management skills between the treatment group and the control group, favoring the treatment group.

Literature review

The existing literature on brain-based learning (BBL) and its application to education reveals a growing, albeit sometimes debated, body of evidence supporting its potential to enhance learning outcomes. BBL, grounded in principles of neuroscience, advocates for instructional practices that emphasize active engagement, meaningful connections, emotional regulation, social interaction, and pattern recognition (Jensen, 2008; Caine & Caine, 2006; Willis, 2006). These principles are posited to align with the brain's natural learning processes, theoretically leading to improved comprehension, retention, and transfer of knowledge.

However, it is important to note that some researchers caution against oversimplifying complex neurological processes and advocate for a more nuanced interpretation of "brain-based" claims (Dekker et al., 2012; Howard-Jones, 2014). While general benefits of BBL, in terms of engagement and motivation, have been documented (Duman, 2010; Willis, 2008; Tokuhama-Espinosa, 2010), its specific application within the context of English as a Foreign Language (EFL) instruction, particularly in writing, warrants further investigation.

A key area of inquiry within EFL education is the development of effective writing skills. Writing, a complex cognitive process, demands the integration of multiple skills: idea generation, organization, grammar, vocabulary, mechanics, and audience awareness (Al-Maliki, 2021; Flower & Hayes, 1981). Traditional EFL writing instruction, particularly in resource-constrained settings, often relies heavily on rote memorization, grammar drills, and product-focused approaches. While these methods have a place, they may not fully engage students' cognitive processes or foster the

development of crucial higher-order thinking skills like critical analysis and synthesis (Abdullah, 2015; Graham, 2019). Studies consistently show that EFL learners, especially at the preparatory level, encounter significant challenges in various aspects of writing, including generating relevant ideas, organizing their thoughts coherently, and expressing themselves with clarity and accuracy (Al-Halayqa, 2018; Hyland, 2003).

BBL offers a theoretically promising alternative to purely traditional approaches by emphasizing active learning strategies designed to stimulate multiple brain regions and promote deeper cognitive processing. Techniques like problem-solving activities, collaborative projects, real-world applications, and the use of visual aids are intended to increase engagement and facilitate deeper understanding (Jensen, 2004; Sousa, 2017; Medina, 2008). For instance, Yagcioglu (2014) demonstrated the positive impact of using interactive, brain-activity-focused websites to improve EFL learners' pronunciation, fluency, and writing skills, particularly in paragraph and essay construction. Similarly, Oradee (2012) found that incorporating mind-based teaching strategies, such as collaborative tasks and role-playing, significantly improved learners' speaking fluency and accuracy in pair-work and group activities, skills which can indirectly support writing development.

The role of emotions in learning is a central, and increasingly emphasized, tenet of BBL. Neuroscience research robustly demonstrates that positive emotions enhance motivation, attention, and the consolidation of memories (Robbins, 2000; Immordino-Yang & Damasio, 2007; Pekrun et al., 2002). Conversely, persistent threat and stress can significantly inhibit learning by triggering the brain's "fight-or-flight" response, which prioritizes survival over higher-order cognitive functions (Goleman, 1995; Arnsten, 1998). Therefore, creating a supportive, emotionally safe, and engaging learning environment is crucial for maximizing learning potential. This encompasses fostering a strong sense of belonging, providing ample opportunities for positive social interaction, minimizing anxiety-provoking situations, and promoting a growth mindset (Caine & Caine, 2002; Dweck, 2006).

Self-management skills, encompassing planning, monitoring, evaluating one's learning, and regulating emotions and behaviors, are also widely recognized as essential for academic success, and are particularly crucial in the complex, iterative process of writing (Al-Thaqafi, 2005; Maher, 2008; Zimmerman, 2002). BBL approaches, by their very nature, may contribute to the development of self-management skills. By encouraging students to take ownership of their learning, set personal goals, reflect on their progress, and collaborate with peers, BBL can foster metacognitive awareness and self-regulation (Al-Mahrezi, 2017; Schunk & Zimmerman, 1998). However, the specific, quantifiable link between BBL interventions and improvements in self-

management within the context of EFL writing remains an area requiring more focused empirical research.

Several studies have investigated the application of BBL principles to improve specific EFL skills, demonstrating its versatility. Research has explored the use of BBL to enhance reading comprehension through strategies like visualization and concept mapping (McNamee, 2011; Buzan & Buzan, 1993), vocabulary acquisition via multi-sensory techniques, and speaking fluency through interactive activities (Duman, 2010; Nation, 2001). Within the realm of writing, studies have examined the effectiveness of BBL in promoting narrative writing skills through techniques like story mapping and emotional engagement (Hernowo, 2015; Wardiani et al., 2016), and improving grammatical accuracy through targeted feedback and collaborative editing (Brown, 2012; Hattie & Timperley, 2007). These studies, while diverse in their methodologies and specific foci, generally support the positive impact of BBL principles on various aspects of EFL learning.

Despite the growing body of research and the theoretical appeal of BBL, there remains a critical need for rigorous, context-specific investigations, particularly within educational settings like Egyptian preparatory schools, which may have unique cultural, linguistic, and pedagogical characteristics. This study directly addresses this gap by examining the impact of a carefully designed, BBL-based instructional course on both EFL writing skills and self-management abilities among third-year preparatory school students in Egypt. The findings will contribute to a more nuanced and evidence-based understanding of the practical application and potential benefits of BBL in EFL education, moving beyond general principles to concrete, measurable outcomes.

Methods and Materials

Participants

The participants in this study were 60 third-year preparatory school students from Al-Balhasi Intermediate School in Somosta, Beni-Suef Governorate, Egypt. Two classes were randomly selected from the school's third-year population. These classes were then randomly assigned to either a treatment group (n=35) or a control group (n=35). This age group (typically 14-15 years old) was chosen because it represents a critical stage in EFL learning, where students are expected to develop more advanced writing skills. All participants were native Arabic speakers learning English as a foreign language. Ethical considerations were addressed by obtaining necessary permissions from the school administration and ensuring informed consent from the students' parents or guardians.

Research Design

A quasi-experimental, pre-test/post-test design was employed in this study. This design was chosen because random assignment of individual students to conditions was not feasible within the

existing school structure. The treatment group received instruction based on a brain-based learning (BBL) instructional course, while the control group received traditional EFL writing instruction, following the standard curriculum prescribed by the Egyptian Ministry of Education. The independent variable was the type of instruction (BBL vs. traditional), and the dependent variables were EFL writing skills and self-management abilities.

Instruments

Three primary instruments were used to collect data in this study:

EFL Writing Skills Checklist: An initial checklist was developed to identify the relevant EFL writing skills appropriate for third-year preparatory students. This checklist was based on a review of the literature, existing EFL curricula, and the specific learning objectives outlined in the third-year English language textbook and teacher's guide used in Egyptian preparatory schools. The initial checklist contained 10 skills.

Validity: Content validity was established through expert review. A panel of university professors specializing in EFL curriculum and instruction, English language supervisors, and experienced EFL teachers (see Appendix 1 of the thesis) reviewed the checklist. They provided feedback on the relevance, clarity, and comprehensiveness of the skills. Based on their feedback, some skills were refined, and others deemed less relevant for this age group (e.g., writing a review of a short story) were removed. The final checklist comprised six core EFL writing skills:

1. Presenting a clear and logical content.
2. Writing a suitable topic sentence.
3. Sticking to the main idea and avoiding irrelevant information.
4. Developing a body with supporting details and examples.
5. Using a conclusion that summarizes the main points.
6. Correctly using mechanics of writing (grammar, spelling, punctuation).

2. **EFL Writing Skills Pre- and Post-Test:** A writing test was developed to assess students' EFL writing proficiency before and after the intervention. The test consisted of six writing prompts, each designed to elicit specific writing skills aligned with the final checklist. The prompts required students to write reviews, short stories, on familiar topics related to the curriculum.
    - **Validity:** The test was subjected to the same expert review process as the checklist to ensure content validity. The jurors evaluated the appropriateness of the prompts for the target age group, the clarity of instructions, and the alignment with the identified writing skills. Modifications were made based on their feedback, including clarifying instructions and adding a welcoming introduction.

- **Reliability:** Inter-rater reliability was assessed. Two independent raters, experienced EFL teachers, scored a sample of 30 tests from a pilot administration using the scoring rubric (described below). Pearson's correlation coefficient between the two raters' scores was 0.98, indicating a high level of inter-rater reliability.

  Pilot Study: A diagnostic test was carried with 30 students to know their level of English. The test included five main skills. The percentage of correct answers in the following skills were: complete sentences (46.6%), write opposites (50%), Perceiving images (53.3%), realizing the error (43.3%) and complete a dialogue (43.3%).

3. **EFL Writing Skills Scoring Rubric:** A detailed scoring rubric was developed to ensure consistent and objective assessment of students' writing performance. The rubric assessed each of the six writing skills on a four-point scale (1-4), ranging from "Poor" to "Excellent." Each level of performance was clearly defined with specific criteria.
   - **Validity:** Content validity was established by the same group of experts with feedback that the rubric had content validity and comprehensiveness.
4. **Self-Management Scale:** A self-report questionnaire was used to measure students' self-management abilities. The scale consisted of 12 items, adapted from existing self-management scales and tailored to the context of EFL learning. The items used a five-point Likert scale (Strongly Disagree to Strongly Agree) to assess aspects of self-management such as goal-setting, planning, time management, and self-monitoring.
   - **Validity:** The scale was reviewed by a panel of experts in educational psychology and EFL instruction to ensure content validity and cultural appropriateness.
   - **Reliability:** The internal consistency reliability of the scale was assessed using Cronbach's alpha. The calculated alpha coefficient was 0.90, indicating high internal consistency.

Materials

- **BBL Instructional Course:** The treatment group received instruction based on a specifically designed BBL instructional course. This course incorporated the principles of BBL (active engagement, meaningful connections, emotional safety, social interaction) into the teaching of EFL writing. The course materials included lesson plans, activities, and resources adapted from the standard third-year English textbook and supplemented with additional materials. The course covered Units 7, 8 and 9 of the prescribed textbook. The strategies adopted included K-W-L strategy, cooperative learning, think-pair-share, and group work. The course spanned over 18 teaching hours.

- **Teacher's Guide:** The researcher developed it to provide clear steps and instructions.
- **Student's Book.**
- **Work Book.**

Procedure

The study was conducted over an eight-week period during the second semester of the 2023-2024 academic year. The following steps were followed:

1. **Pre-testing:** Both the treatment and control groups were administered the EFL Writing Skills Pre-Test and the Self-Management Scale.
2. **Intervention:** The treatment group received instruction using the BBL-based instructional course, delivered by the researcher. The control group received traditional EFL writing instruction, delivered by their regular classroom teacher. The BBL instruction involved a variety of activities designed to engage students actively, such as group projects, discussions, role-plays, and the use of visual aids and real-world examples. Emphasis was placed on creating a positive and supportive learning environment. The duration of the course was 8 weeks.
3. **Post-testing:** At the end of the eight-week intervention period, both groups were administered the EFL Writing Skills Post-Test and the Self-Management Scale. The post-test was identical to the pre-test.
4. **Data Analysis:** using t-tests for independent samples to determine if the changes observed in the experiment is statistically significant or not.

   The next section, "Results," will present the findings of the statistical analyses conducted on the collected data.

Findings

This section presents the findings of the study, organized to directly address each research question and its associated hypothesis. Statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences).

Research Question 1: Group Equivalence at Baseline

- **Research Question 1:** *Were the treatment and control groups equivalent in EFL writing skills at the beginning of the study?*
- **Hypothesis 1 (Null Hypothesis):** There is no statistically significant difference in EFL writing skills between the treatment group and the control group at baseline (pre-test).

To address this question and test Hypothesis 1, an independent samples t-test was conducted to compare the mean scores of the two groups on the EFL Writing Skills Pre-Test.

Table 1

Independent Samples t-test for EFL Writing Skills Pre-Test Scores

Group	**N**	**Mean**	**SD**	***t***	***df***	***p***
Treatment	35	16.74	1.837	-0.762	68	0.449
Control	35	17.06	1.608			

The results, presented in Table 1, indicate that there was no statistically significant difference between the treatment group (M = 16.74, SD = 1.837) and the control group (M = 17.06, SD = 1.608) on the EFL Writing Skills Pre-Test, $t(68) = -0.762$, $p = .449$. Therefore, we *fail to reject* the null hypothesis (H1). The two groups were statistically equivalent in terms of their EFL writing skills at the beginning of the study.

Research Question 2: Effect of BBL on EFL Writing Skills (Between Groups)

- **Research Question 2:** *Is there a statistically significant difference in EFL writing skills between students who receive BBL-based instruction and those who receive traditional instruction?*
- **Hypothesis 2 (Alternative Hypothesis):** There is a statistically significant difference in EFL writing skills between the treatment group (receiving brain-based learning instruction) and the control group (receiving traditional instruction) at post-test, with the treatment group demonstrating significantly higher scores.

To address this question and test Hypothesis 2, an independent samples t-test was conducted to compare the post-test mean scores of the treatment and control groups.

Table 2

Independent Samples t-test for EFL Writing Skills Post-Test Scores

Group	**N**	**Mean**	**SD**	***t***	***df***	***p***	**Cohen's *d***
Treatment	35	71.63	1.646	46.584	68	< .001	2.81
Control	35	47.74	2.548				

The results, shown in Table 2, reveal a statistically significant difference between the treatment group (M = 71.63, SD = 1.646) and the control group (M = 47.74, SD = 2.548) on the EFL Writing Skills Post-Test, $t(68) = 46.584$, $p < .001$. The effect size, Cohen's d = 2.81, indicates a very large effect. Therefore, we *reject* the null hypothesis and *support* the alternative hypothesis

(H2). The BBL-based instructional course had a statistically significant and practically large positive effect on students' EFL writing skills compared to traditional instruction.

Research Question 3: Improvement in EFL Writing Skills (Within Treatment Group)

- **Research Question 3:** *Is there a statistically significant improvement in EFL writing skills within the BBL treatment group from pre-test to post-test?*
- **Hypothesis 3 (Alternative Hypothesis):** There is a statistically significant improvement in EFL writing skills within the treatment group from pre-test to post-test.

To address this question and test Hypothesis 3, a paired samples t-test was conducted to compare the pre-test and post-test scores within the treatment group.

Table 3

Paired Samples t-test for EFL Writing Skills (Treatment Group Only)

	N	**Mean**	**SD**	***t***	***df***	***p***	**Cohen's *d***
Pre-Test	35	16.74	1.837	-122.85	34	< .001	38.85
Post-Test	35	71.63	1.646				

As presented in Table 3, there was a statistically significant improvement in the treatment group's EFL writing skills from pre-test (M = 16.74, SD = 1.837) to post-test (M = 71.63, SD = 1.646), $t(34) = -122.85$, $p < .001$. The effect size, Cohen's d = 38.85, represents a very large effect. Therefore, we *support* the alternative hypothesis (H3). The BBL intervention resulted in a statistically significant and practically large improvement in EFL writing skills within the treatment group.

Research Question 4: Effect of BBL on Self-Management Skills

- **Research Question 4:** *Is there a statistically significant difference in self-management skills between students who receive BBL-based instruction and those who receive traditional instruction?*
- **Hypothesis 4 (Alternative Hypothesis):** There is a statistically significant difference in self-management skills between the treatment group and the control group, favoring the treatment group.

To address this research question and test hypothesis 4, an independent sample t-test was carried to display the results.

Table 4

Independent Samples t-test for Self-Management Scale Scores

Group	N	Mean	SD	*t*	*df*	*p*	Cohen's d
Treatment	35	41.66	1.083	40.633	68	<.001	9.16
Control	35	28.34	1.608				

As shown in Table 4, there was a statistically significant difference between the treatment group (M = 41.66, SD = 1.083) and the control group (M = 28.34, SD = 1.608) on the Self-Management Scale, $t(68) = 40.633$, $p < .001$. The effect size (Cohen's d) was *9.16*, indicating a very large effect. This data indicates the BBL group improved significantly. Therefore, H4 is accepted.

Discussion

This study investigated the impact of a brain-based learning (BBL) instructional course on the EFL writing skills and self-management abilities of third-year preparatory school students in Egypt. The findings provide strong support for the effectiveness of BBL in this context, aligning with and extending previous research on BBL and EFL learning.

EFL Writing Skills:

The results clearly demonstrated that the BBL intervention had a statistically significant and practically large positive effect on students' EFL writing skills. This was evident in both the between-groups comparison (Research Question 2, Hypothesis 2), where the treatment group significantly outperformed the control group on the post-test, and the within-group analysis (Research Question 3, Hypothesis 3), where the treatment group showed substantial improvement from pre-test to post-test. These findings are consistent with a growing body of literature supporting the efficacy of BBL principles in enhancing learning outcomes (Jensen, 2008; Caine & Caine, 2006; Willis, 2006; Tokuhama-Espinosa, 2010).

The large effect sizes observed in this study suggest that the BBL approach was particularly effective in promoting EFL writing proficiency. Several factors likely contributed to this success. First, the BBL instructional course emphasized *active engagement* through various activities, such as group projects, discussions, and role-plays. This active involvement is consistent with constructivist learning theories (Michael, 2006) and neuroscientific evidence indicating that active processing enhances memory and understanding (Bransford et al., 2000). Students were not merely passive recipients of information; they were actively constructing their knowledge of writing skills.

Second, the BBL course prioritized *meaningful connections* by relating the learning material to students' prior knowledge and experiences. This approach aligns with the principle that the brain

learns more readily when new information is linked to existing neural networks (Bransford et al., 2000). By making the writing tasks relevant and relatable, the BBL intervention likely facilitated deeper processing and improved retention.

Third, the focus on creating a positive and supportive *emotional environment* likely contributed to the observed improvements. Research consistently demonstrates the crucial role of emotions in learning (Immordino-Yang & Damasio, 2007; Pekrun et al., 2002). The BBL course aimed to reduce anxiety and promote a sense of belonging, which may have freed up cognitive resources for learning and allowed students to take more risks in their writing.

The use of collaborative activities, a key element of BBL's emphasis on *social interaction* (Vygotsky, 1978; Johnson & Johnson, 2009), likely also played a significant role. Peer interaction provided opportunities for students to share ideas, receive feedback, and learn from one another, fostering a sense of community and shared responsibility for learning. This aligns with findings from Yagcioglu (2014) and Oradee (2012), who demonstrated the benefits of collaborative activities in improving EFL speaking and writing skills.

Self-Management Skills:

The study also found a statistically significant and very large positive effect of the BBL intervention on students' self-management skills (Research Question 4, Hypothesis 4). This suggests that the BBL approach not only improved writing proficiency but also enhanced students' ability to plan, monitor, and evaluate their learning. This finding is particularly important because self-management skills are crucial for independent learning and lifelong success (Al-Thaqafi, 2005; Maher, 2008; Zimmerman, 2002).

The emphasis on active engagement, meaningful connections, and collaborative learning within the BBL course may have indirectly fostered self-management skills. By encouraging students to take ownership of their learning, set goals, and reflect on their progress, the BBL approach likely promoted metacognitive awareness and self-regulation (Schunk & Zimmerman, 1998). The collaborative activities also provided opportunities for students to observe and learn self-management strategies from their peers.

Limitations:

While the findings of this study are promising, it is important to acknowledge some limitations. First, the quasi-experimental design, while necessary due to practical constraints, does not allow for the same level of causal inference as a true experimental design with random assignment of individual participants. Second, the study was conducted in a specific context

(Egyptian preparatory schools), and the findings may not be generalizable to other populations or educational settings. Third, the study relied on self-reported measures of self-management, which may be subject to social desirability bias. Future research could incorporate observational measures or other forms of assessment to provide a more comprehensive picture of self-management skills.

Future Research Directions:

This study opens up several avenues for future research:

1. **Replication and Generalizability:** Replicating this study in different contexts (e.g., different age groups, different countries, different language backgrounds) would help to establish the generalizability of the findings.
2. **Longitudinal Studies:** Investigating the long-term effects of BBL interventions on EFL writing skills and self-management would be valuable.
3. **Qualitative Research:** Conducting qualitative studies (e.g., interviews, classroom observations) could provide richer insights into the mechanisms through which BBL impacts learning. This could help to identify the specific aspects of the BBL intervention that were most effective.
4. **Specific BBL Components:** Future research could isolate and investigate the impact of specific BBL components (e.g., the use of visual aids, the role of music, the effects of different types of collaborative activities) to determine their relative contributions to learning outcomes.
5. **Teacher Training:** Investigating the effectiveness of different approaches to training teachers in BBL principles and practices would be beneficial.

Conclusion:

This study embarked on an investigation into the potential of brain-based learning (BBL) to address a critical need in English as a Foreign Language (EFL) education: the improvement of writing skills and the cultivation of self-management abilities in young learners. The compelling evidence emerging from this research, conducted with third-year preparatory school students in Egypt, strongly supports the integration of BBL principles into EFL writing instruction. The statistically significant and practically large improvements observed in both EFL writing proficiency and self-management skills within the treatment group underscore the transformative potential of this approach.

The core finding of this study – that a carefully designed BBL instructional course can significantly outperform traditional teaching methods in enhancing EFL writing – is not merely a statistical outcome; it represents a paradigm shift in how we approach language learning. Traditional, often rote-based, methods frequently fail to fully engage the learner's cognitive and

emotional capacities. BBL, in contrast, by actively involving students in meaningful, collaborative, and emotionally supportive learning experiences, taps into the brain's inherent learning mechanisms. This study demonstrates that this alignment with natural learning processes translates directly into measurable gains in writing performance. Students in the BBL group weren't just learning *about* writing; they were learning *to write* more effectively, demonstrating improved idea generation, organization, grammatical accuracy, and overall fluency.

Furthermore, the significant enhancement of self-management skills within the BBL group highlights the broader impact of this approach. Self-management, the ability to plan, monitor, and evaluate one's own learning, is not just an academic asset; it's a life skill. The BBL intervention, by fostering a sense of ownership, encouraging goal-setting, and promoting metacognitive reflection, empowered students to become more independent and effective learners. This suggests that BBL can contribute not only to improved EFL proficiency but also to the development of crucial self-regulatory capacities that will benefit students throughout their academic careers and beyond.

The practical implications of these findings are substantial. For educators, this research provides a strong rationale for moving away from solely teacher-centered, transmission-based models of instruction and embracing learner-centered, active learning approaches. The specific strategies employed in the BBL course – collaborative projects, real-world applications, emotionally supportive environments, and opportunities for peer interaction – offer concrete examples of how BBL principles can be translated into effective classroom practices. Teacher training programs should incorporate these principles, equipping educators with the knowledge and skills to implement BBL effectively.

For curriculum developers, this study highlights the need to design EFL materials that are not only linguistically sound but also cognitively and emotionally engaging. This means incorporating activities that promote active learning, meaningful connections, and collaboration. It also means creating assessments that go beyond rote memorization and grammar drills to evaluate students' ability to apply their knowledge and skills in authentic writing contexts.

For policymakers, this research provides evidence to support investment in BBL-informed educational reforms. While implementing BBL may require changes in teacher training, curriculum design, and classroom practices, the potential benefits for student learning and long-term success justify the effort.

While this study provides compelling evidence for the effectiveness of BBL, it also acknowledges the need for ongoing research. Future studies should explore the long-term impact of BBL interventions, investigate the specific mechanisms through which BBL enhances learning, and

examine the applicability of BBL in diverse cultural and linguistic contexts. The use of qualitative data would also help discover the best practices related to the BBL.

In conclusion, this research contributes significantly to the growing body of evidence supporting the transformative potential of brain-based learning. By embracing the principles of BBL, educators can create more effective, engaging, and empowering learning experiences for EFL students, fostering not only improved language proficiency but also the development of essential self-management skills that will serve them well throughout their lives. This study is not just about improving writing scores; it's about fostering a deeper, more meaningful, and ultimately more successful approach to EFL education.

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