

The Investigation of the Relationship between Brain Executive Function and Writing Skills with the Mediating Role of Self-Regulatory English Learning Strategies

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Abstract

Based on the integrated and Distinctive view of Miyak et al. (2000), Executive Functions are a set of related and distinct structures that allow individuals to strive for self-regulation, thoughts, and actions towards the goal of Special help. Self-regulation as metacognitive knowledge as defined by Flavell (1979) and follows Dornyei's (2005) call to focus on the psychological perspectives of language learning. This study aimed to explore the relationship between a deficiency in the executive function of the brain and writing skills through the mediation of self-regulatory strategies. In this study, 150 Iranian EFL university students were selected. Using Simple random sampling of a population of 630 .they were asked to fill out a self-regulatory strategy questioner by Wang and Bai (2013) and a questionnaire of efficacy in the executive function of the brain by Barkley (2011) and during the course, students were asked to write 7 pieces of writing in the General genre. The study Method was a Descriptive type of correlation. Structural equation modeling was used to analyze data. The research model had a good fit and the factor structure considered acceptable. The results of the study showed that there was a correlation among research variables at the level of 0.01. Considering individual differences, including executive function of the brain, and improving these differences by applying English language learning strategies can be effective in increasing writing skills.

Keywords: brain executive function, writing, self-regulatory strategies.

1. Introduction

1.1 brain executive function

Executive action refers to a set of processes that use excellent brain cognition to manage purposeful behavior. Components included Self-control/inhibition; working memory, self-organizing/problem solving, self-monitoring, self-motivation, emotional self-regulation, and time management are examples of executive functions. Executive performance of the forehead, especially the prefrontal cortex, is responsible for executive function in this part of the brain. Inadequate executive function and its components have been linked to a variety of neurological

disorders, including autism spectrum disorders, attention-deficit/hyperactivity disorder, dysfunction, and learning disabilities.

The concept of executive function originated in the field of neuroscience and is now widely used to describe conscious functions as well as the processes involved in the conscious control of thought, action, and emotion (Badli, 1996). These functions include planning, organizing, problem-solving, working memory, and decision making (Lezak, Hovinson, & Loring, 2004), as well as neural processes involved in information acquisition, processing, storage, and utilization (Shuttleworth, 2010), which are the Connector between behavior and brain structure (Hill, Olivot, Shelton, Pla, (Ogil and Govier, 2010).

Multiple theories have been proposed regarding the organization of executive functions (EF); Some consider executive functions as a single process (Athenhofer, Hambrick & Abels, 2006) that helps organize high-level cognitive abilities (Della Sala, S., Gray, C., Spinnler, H., & Trivelli, C.)

. Other researchers have proposed a multidimensional concept of executive functions (Hill, 2004). Anderson (2002) proposed a four-process model that integrates four subsystems to form an executive control system: (1) cognitive flexibility (working memory and distributed attention), (2) goal setting (planning and initiating), (3) information processing (fluidity and processing speed), and (4) attention control (self-regulation and self-monitoring). Diamond (2013) also proposed a three-factor model of executive function in which inhibition, working memory and cognitive flexibility work together to influence high-level executive functions such as reasoning, planning, and problem-solving. An alternative view to views based on the executive functions of the unit and multiple is an integrated view, based on the integrated and distinct view of Miyak et al. (2000).Executive functions are a set of related and distinct structures that help people in the self-regulatory effort, their thoughts and actions towards a specific goal.

1.2 self-regulatory strategies

Self-regulation is another construct that has been investigated in this study and includes the following sub-constructs; Self-evaluation, Organization and transformation, Rehearsal and memorization, Seeking social assistance, Persistence when faced with challenges, Seeking opportunities to practice English, Recording and monitoring, Self-consequences, Goal setting and planning, Review of records, and Interpretation guessing.

In foreign language acquisition, autonomous learning and effective self-regulatory mechanisms are becoming increasingly vital. Without them, students may be unable to take advantage of learning possibilities outside of language classrooms.

The concept of self-regulation proposed by Zimmerman and Schunk (2001), which is based on English and English (1958), may be useful in distinguishing seemingly intertwined conceptions of motivation and self-regulation. According to Zimmerman and Schunk, Self-regulation is the management of one's current behavior based on reasons relating to a future goal or ideal that an individual has established for himself. Many definitions incorporate learners' control over their ideas (e.g., their competence beliefs), emotions (e.g., anxiety experienced while learning), behaviors (e.g., how they perform a learning assignment), and the learning environment (Pintrich & De Groot, 1990; Zimmerman, 1998). For a long time, SLA research was primarily concerned with how learning strategies are employed in the pursuit of language learning objectives. (e.g., Macaro, 2001; O'Malley & Chamot, 1990; Oxford, 1990;

Wenden, 1998).

Dornyei also suggested a novel theoretical model of self-regulation in SLA, which is based on Kuhl (1985) and Corno and Kanfer's taxonomies (1993). Tseng, Dornyei, and Schmitt (2006) conducted an empirical investigation that supports the validity of Dornyei's (2001) taxonomy of five basic categories of control strategies: Goal commitment is regulated by commitment control; metacognitive control is regulated by metacognitive control, which helps learners maintain focus and concentration; satiation control, with the help of which boredom can be managed and alleviated; emotion control, which is used to manage emotions; and environmental control, which assists learners in creating an appropriate study environment.

1.3 writing skills

Abdullah et al. (2011) studied the **English writing methods of four ESL Malay undergraduate engineering students at a local private institution** in an Asian environment. Both talented and unskilled students used similar writing techniques to produce ideas in essay writing, namely cognitive, metacognitive, and social techniques. Furthermore, Chen (2011) found a link between writing techniques and performance among Chinese non-English majors. The findings revealed that students' writing abilities correlated favorably with their pre-writing and revision procedures.

In terms of cognitive compensatory techniques, Anitah et al. (2008) defined cognitive activity as any activity that occurs in the brain to learn a foreign language. Concerning Brown's (2007) micro-and macro-skills of writing, it may be claimed that cognitive techniques can increase the micro-skills of writing that deal heavily with words, patterns, meaning, and function entirely in the writer's brain.

On the other hand, learners' cognitive techniques differ because they use diverse language processing processes (Cohen & Macaro, 2007). **Consequently**, teachers must be aware of and comprehend variances in students' cognitive processes to provide instructional learning activities that are appropriate for their cognitive strategies.

2. Method

2.1 Participant

Female university students between the ages of 18 and 25 years participate part in this study. A total of 150 EFL University students from Iran were enrolled in General English classes. The study population comprised 360 persons, Sample of the study was determined using the Cochran technique to be 150 persons (Sarmad et al,1395).

2.2 Instrument

The Psychometric Properties of the Barkley Deficits in Executive Functioning Scale (BDEFS) in a College Student Population is used. This questionnaire has 89 questions that were designed and developed by Barclay (2012) which has five subscales or subsets. High scores on any scale can be a sign of a defect in executive function in daily activities. The scoring method for the questionnaire was the Likert scale. The answer "never or rarely" is given a score of 1 and the answer "most of the time" is given a score of 4. Items 1, 6, 14, 16, 24, 49, 50, 55, 60, 65, and 69 have a reverse score: the answer "most of the time" is given a score of 4 and the answer "never or rarely" is given a score of 1. Individual scores are obtained from the sum of the scores on each subscale. High scores on any scale can be a sign of a defect in that area of executive function in daily activities.

Questioner of English Self-Regulated Learning Strategy (QESRLS).

The Questionnaire of English Self-Regulated Learning Strategies (QESRLS) by Wang Bai (2013) was created using the self-regulation cyclical loop and comprised 65 items in 11 categories. Goal-setting, making adjustments, and seeking social assistance are all parts of the

context. The students were instructed to select one of the four options to answer: 0 (I never use it), 1 (I seldom use it), 2 (I sometimes use it), and 3 (I often use it).

Writing Composition

Writing Criteria were Content extent, relevance, subject knowledge, Organization coherence, fluency, clarity, logical sequencing, Vocabulary richness, appropriate register, word form mastery, Language use accuracy (usage of articles, word order, tenses, prepositions, and sentence constructions), Mechanics paragraphing, spelling, capitalization, and punctuation. Students received their evaluations in percentage Bacha's model (2001) – Jacobs (1981).

2.3 Data Collection and Procedure

To gather data, students were required to answer The Psychometric Properties of the Barkley Deficits in Executive Functioning Scale (BDEFS) in a College Student Population and a Questioner on English Self-Regulated Learning Strategy (QESRLS) in an online setting. The Students were asked to submit 7 assignments to the General genre.

Students were asked to answer two questioners; the Questioner of English Self-Regulated Learning Strategy (QESRLS). The internal consistency (Cronbach's alpha) of the QESRLS was .92 for both the first (QESRLS_1) and second assessments (QESRLS_2). The test-retest reliability was .79. The Psychometric Properties of the Barkley Deficits in Executive Functioning Scale (BDEFS) **was used for college students in the online setting**. Cronbach's alpha coefficients for subscales between 0.80 to 0.92 and for all subjects 0.96 and for subscales between 0.87 to 0.96 Obtained; this result indicates good validity of the scale. The results of the confirmatory factor analysis also showed a five-factor scale model.

Failure in the Barclays Executive Council (time self-management, self-organization/problem solving, self-motivation, self-control/inhibition, emotion self-regulation problems) fits well in Iranian society, so scale validity is desirable.

Students were asked to submit 7 assignments in the General genre, they were to write once in two weeks. Students were required to self-study the materials implemented in their online e-learning course on a set date given to them. Essays were evaluated according to Bacha's model (2001) – Jacobs (1981).

3. Result

The present study investigates the relationship between brain executive function and writing skills with the mediating role of self-regulatory English learning strategies in the general English curse of students of Farhangian University in Tehran.

3.1 Inferential findings of the research

-Evaluation of data normality using Kolmogorov-Smirnov test:

The k-s-z statistic at the level of $\leq p 0.05$ was not significant for all variables, so the distribution of the research variables follows a normal distribution.

3.2 Findings related to the research hypothesis

Estimation and testing of measurement patterns (confirmatory factor analysis patterns).

To determine the acceptability of the indicators for the measurement patterns, separate measurement patterns were drawn and calculated.

Table 1: General indicators of fit of measurement patterns

indicator	The impaired executive function of the brain	Self-regulatory strategies for learning English	Learn writing skills	Optimal amount	Condition
χ^2	34.31	90.93	28.19	-	-
RMR	0.036	0.041	0.032	< 0.05	Optimal
CFI	0.96	0.93	0.91	>0.90	Optimal
IFI	0.96	0.93	0.91	> 0.90	Optimal
PGFI	0.58	0.72	0.66	>0.50	Optimal
RMSEA	0.065	0.088	0.055	<0.1	Optimal
CMIN/DF	2.57	2.16	2.84	1-3	Optimal

Finally, according to the table above, it can be said that the measurement patterns have a good fit, in other words, the general indicators confirm that the data **support the patterns well**. Considering that the amount of factor loads is almost higher than 0.50 in most cases and considering the partial index P (with a value of Sig <0.05 for all items) and general indicators, it can be inferred that items measure data well.

3.3 Analysis of research hypothesis

The structural pattern of brain executive dysfunction and learning of writing skills with the mediating role of self-regulatory English learning strategies in students was appropriate and had a significant relationship.

Before examining the hypotheses, the correlation between the variables was evaluated. The correlation test was used and the results are given in the matrix below

Table 2: Correlation matrix between variables of research hypothesis

		correlation		
		The impaired executive function of the brain	Self-regulatory learning strategies Total	writing skills
The impaired executive function of the brain	Pearson Correlation	1	-.441	-.546
	Sig. (2-tailed)		.000	.000
	N	147	147	147
Self-regulatory learning strategies Total	Pearson Correlation	-.441	1	.873**
	Sig. (2-tailed)	.000		.000
	N	147	150	150
Writing skills	Pearson Correlation	-.546	.873**	1
	Sig. (2-tailed)	.000	.000	
	N	147	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

It is clear from the above matrix, the sign ** indicates the existence of a correlation between the research variables at the level of 0.01. That is, there is a link between impairments in the

executive functions of the brain and self-regulatory strategies for learning English and writing skills.

To investigate the effect and relationship between executive functions of the brain and learning writing skills with the mediating role of self-regulatory strategies for learning English in students, the structural equation model was used. **Table 3 presents** the general indicators obtained from the fit of the structural equation model related to the research hypotheses .

Table 3: General indicators of structural equation model fit of research hypothesis

Indicator	Amount	Optimal amount	Condition
χ^2	239.73	-	-
RMR	0.038	< 0.05	Optimal
CFI	0.93	>0.90	Optimal
IFI	0.93	> 0.90	Optimal
PGFI	0.69	>0.50	Optimal
RMSEA	0.086	<0.1	Optimal
CMIN/DF	2.08	1-3	Optimal

The results in Table (3) show that the ratio of chi-square to the degree of freedom of CMIN / DF is equal to 2.08, absolute RMR fit index less than 0.05, adaptive fit indices CFI and IFI more than 0.90, the good fit index of PGFI is equal to 0.69 and the RMSEA index of 0.086 is at an acceptable level, which means that the research model has a good fit and the factor structure considered for it is acceptable.

Figure 1: Structural equation model of research hypothesis

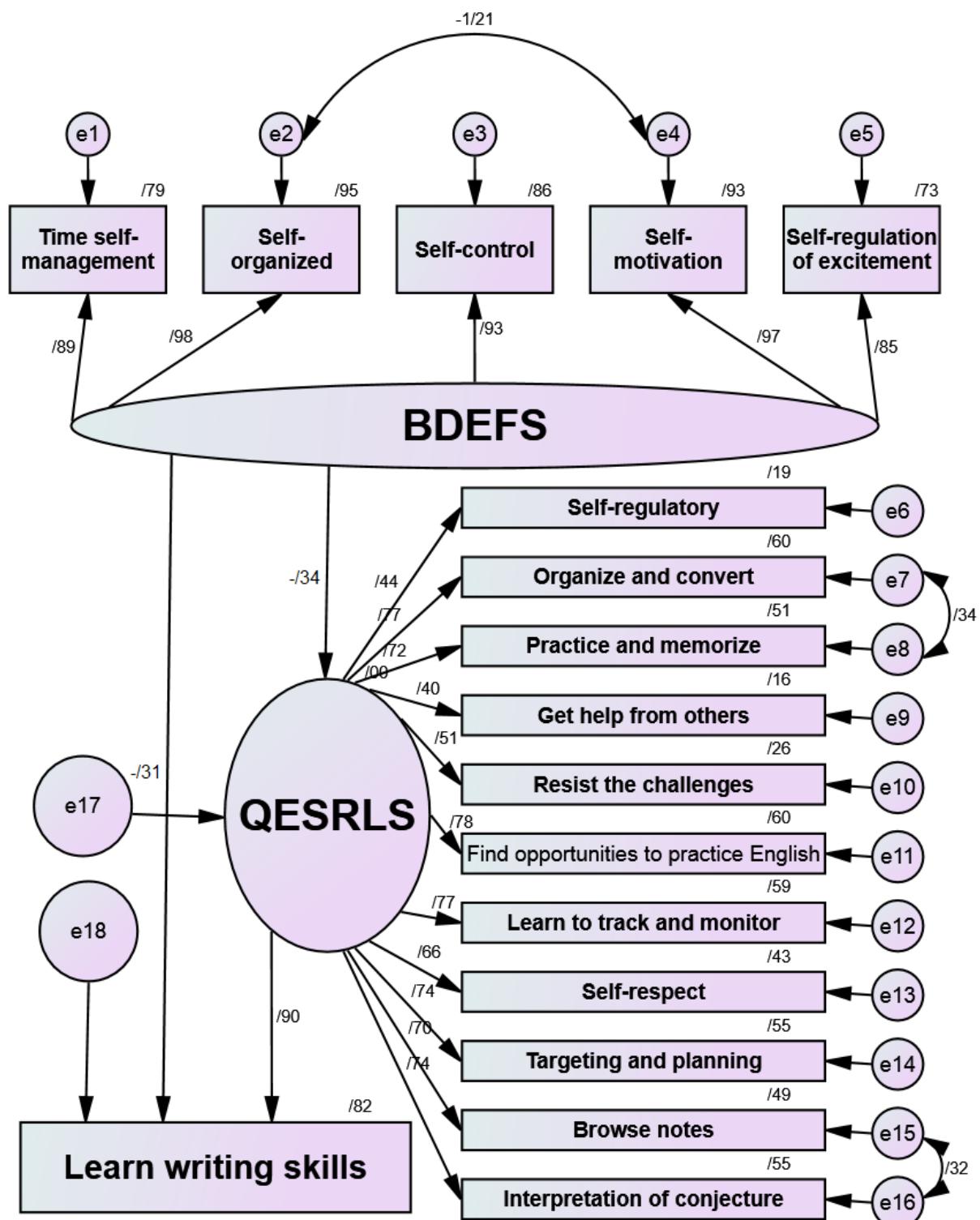


Table 4: Regression coefficients and critical values for the research hypothesis

Path of variables	Regression Weights	C.R	P
The impaired executive function of the brain Self-regulatory strategies for learning English	-0.34	-3.81	0.003

writing skills	Self-regulatory strategies for learning English	0.90	5.53	0.000
The impaired executive function of the brain writing skills		-0.31	-3.44	0.005

Table (4) shows the regression coefficients along with the critical values for the research hypothesis. As it turns out, the relationship between the variables is accepted.

To investigate the direct and indirect effects of independent variables on dependents, it is necessary to provide the total, direct and indirect effects for the endogenous variable of the model, which can be seen in the following tables.

Table 5: Separation of direct and indirect effects for the research hypothesis

independent variable	The dependent variable	Effect		
		direct impact	Indirect effect	General effect
The impaired executive function of the brain	Self-regulatory strategies for learning English	-0.34	-	-0.34
Self-regulatory strategies for learning English	Learn writing skills	0.90	-	0.90
The impaired executive function of the brain	Learn writing skills	-0.31	-0.34 * 0.90 = -0.31	0.62

As can be seen in Table (5), the effect and relationship between impaired executive functions of the brain and learning writing skills with the mediating role of self-regulatory strategies for learning English in students was 0.62.

4. Discussion

The current study sought to investigate the possible relationship between brain executive function and writing skills with the mediating role of self-regulatory English learning strategies. According to the previous researches, these factors have a positive association. The results indicate the existence of a correlation between the research variables at a level of 0.01. That is, there is a link between impairments in the executive functions of the brain and self-regulatory strategies for learning English and writing skills.

According to the findings, it can be said that the measurement patterns have a good fit, in other words, the general indicators confirm that the data well support the patterns. Considering that the amount of factor loads is almost higher than 0.50 in most cases and considering the partial index P (with a value of Sig <0.05 for all items) and general indicators, it can be inferred that items measure data well.

The ratio of chi-square to the degree of freedom of CMIN / DF is equal to 2.08, absolute RMR fit index is less than 0.05, adaptive fit indices CFI and IFI are greater than 0.90, the good fit index of PGFI is equal to 0.69 and the RMSEA index of 0.086 is at an acceptable level, which means that the research model has a good fit and the factor structure considered for it is acceptable.

To investigate the direct and indirect effects of independent variables on dependents, it is necessary to provide the total, direct and indirect effects for the endogenous variable of the model.

The effect and relationship between impaired executive functions of the brain and learning writing skills with the mediating role of self-regulatory strategies for learning English in students are 0.62. The outcome of this research is consistent with prior findings. Mistar (2011) classifies self-evaluation strategies for learning a new language as a discrete category of learning strategies, which is explored by the first sub-scale of the current study. Self-monitoring and self-evaluation procedures are classified as metacognitive strategies by Oxford (1990). Furthermore, these strategies are referred to as rewriting writing strategies by Kieft et al. (2006) and Chen (2011) are explored in the second sub-scale of this research. Torrance et al. (1994) admit that some students prefer to use revising strategies. They divide the subjects into three groups: those who prefer planning, those who prefer revising, and those who prefer both planning and revising. Less successful students are more likely to use the strategies.

The conclusions of numerous additional research, but deal with learning English in general. Mistar (2006), for example, discovered that the adoption of learning techniques was the strongest predictor of English competence among Indonesian university students. Park (1997) also came up with a conclusion that learning strategies influenced learning competency considerably among students of English in a Korean university.

Khalil (2005) discovered that the learners' competence level influenced the total learning approach utilization in Palestine. Wu (2008) discovered that high- and low-proficiency students in Taiwan adopted distinct tactics. Chen (2011) discovered that pre-writing and revision procedures positively related to students' writing in the context of developing writing skills.

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