

# Building Executive Function with Technology Support: Brain Based Teaching Strategies

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## **Building Executive Function with Technology Support: Brain Based Teaching Strategies**

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This study investigated the difference effect of implementing brain based teaching (BBT) by building executive function (EF) with technology support. A quantitative research design with factorial 2 x2 was applied, then two classes involving each 38 student of a private college in Indonesia in the fourth grade were chosen as the sample. The instruments used were a questionnaire and a test. Two-way ANOVA was applied to analyze the data. The findings showed that (1) There was different effect between experimental class and control class in students' reading achievement, (2) the students' achievement in Reading course with high motivation got higher achievement than those low motivation is really true, (3) There was an interaction between teaching strategies and students' motivation level in reading comprehension. Educators of ELT have to integrate BBT and EF for the meaningful learning. Further research and development on different brain based teaching strategies is suggested.

**Keywords:** brain based teaching, executive function, students' motivation level, reading Comprehension.

### **INTRODUCTION**

Educators have many various problems during the Covid 19 Pandemic. They must hold their class full online. They cannot meet their students face to face. The teaching and learning process sometimes have many distractions which are caused by some factors. Students often feel frustrated with fully online learning. Many educators just give many tasks to students without paying attention to the way students learn. As educators, they have to know how learning occurs in students' brains to maximize the learning process (Caine & Caine, 1990 & 2012; Jensen & Sausa, 2001). To reach the optimum teaching process, brain based teaching strategies by building executive function with technology support was implemented in this study. Executive function is used to consciously control students' thoughts, emotions and actions in order to achieve the goals. The executive function affects learning by making the students how to organize, manage time and plan in their learning activities. Brain based teaching strategies by building executive function in this study was implemented by creating a positive emotion environment in online classroom.

Some studies conducted found that a brain - based learning approach helps teachers to find the way they should teach their students. The emotional basis is the core of the learning process. (Rukminingsih, 2018; Parr, 2016; and Salem, 2017) Garcia et al. (2014) also found that to comprehend the text need some learning process including inferencing and integration of prior knowledge with information of the text during reading. Executive function is the management system of the brain. It is associated with students' academic achievement. Some studies dealing with building executive function found that executive function and the neural network in the brain system can improve the students' achievement and motivation (Jacob & Parkinson, 2015; Zewelanjani et al., 2016; Chevalier et al., 2015).

Therefore, the purpose of this study is to investigate if brain-based teaching strategies by building executive function with technology support can be considered as a useful and meaningful learning environment in online learning that could support their reading achievement. This research enables educators and researchers to understand how the student's brain works and learns by building their executive function can contribute to English language learning, especially in EFL reading courses. In addition, we can have a better picture of how foreign language learners can improve and motivate themselves during full online learning, especially in terms of reading courses. With such knowledge, researchers and educators will be able to consider and develop students' executive function, appropriate and creative pedagogical ideas or teaching strategies that make effective use of brain-based teaching strategies for EFL reading achievement. The research question of this study are:

1. Is there a different effect between students who are taught by brain-based teaching strategies by building executive function with technology support with students who are taught by conventional class?
2. Do the students' achievement in Reading course with high motivation get higher achievement than those with low motivation?
3. Is there an interaction between teaching strategies and students' motivation level in reading course?

## LITERATURE REVIEW

### Brain Based Teaching Strategies

Based on some studies above, educators should choose appropriate teaching strategies to cultivate students' motivation. Brain based teaching strategies by building executive function with technology support can stimulate the students' brain work to learn EFL reading comprehension. Educators in the pandemic Covid 19 era face many problems in teaching by distance education. Brain based teaching is understanding the principles of brain based learning which involve three instructional techniques which can be implemented in the classroom (Caine & Caine, 1994). Three instructional techniques associated with brain based learning involving orchestral immersion which builds a learning environment which fully engaged students in the class; Relaxed Alertness which removes fear in the learners while they are learning; and active processing which lets the learners combine and assume materials by actively practicing them (Caine and Caine, 1990 & 2016).

Students' brains work properly in multifaceted experiences. They need to have various tasks and also teaching strategies. According to Caine and Caine (1994) that the brain is unique, learning is changing because it is changing in the brain. To change on long term memory, the brain needs experiences that support the changes which occurred. Those kinds of multifaceted experiences include multisensory input, rewards and motivation, prior knowledge, some examples from concrete to abstract, more practices, telling stories and using computers and other forms of technology. The brain works effectively by seeking the patterns that humans store in their brain by mapping and chunking the information. The information stored in our brains is stored as patterns. As we watch someone write a word, our brain starts retrieving words that might fit the pattern. It is engaging, and it calls for immediate connections. Chevalier (2015) stated the only way to detect patterns is to have them stored in the brain. It is imperative that educators take new information, help students "see" the patterns, associate those patterns with older patterns stored in the brain, and create new ones.

Brain-based teaching strategies creates some meaningful learnings which makes the brain work well. As the brain seeks a pattern, it also looks for meaning especially personal meaning. Every student has various meaningful learning. What is meaningful to our students may be very different from what is meaningful to us. Relational memory occurs when students

can relate new learning to something that has happened previously in their lives. Adding to patterns or maps previously stored and mastered makes learning much easier (Willis, 2006). Educators should provide an environment which lessens stress. A positive climate environment classroom leads the students to feel safe and comfortable. Lowering stress increases learning. Stressed brains don't learn in the same way as brains that aren't stressed. Students who feel they excel in an area at school will feel better about themselves, and their brains will release chemicals that make them feel good, like dopamine and serotonin, rather than the stress chemical cortisol. Stress increased cortisol, but the amount of cortisol was not directly related to the effects of stress on memory. This means that if you create more cortisol during your stress response, this won't necessarily mean that your memory will be more impaired than someone who is less hormonally-responsive (Shields, 2017).

### **Executive Function with Technology Support**

Executive function is a top-down monitoring and control process which activates the learners' behavior (Diamond 2016). The main executive functions are involving inhibition (controlling one's behavior, attention, thoughts and emotions), working memory (temporarily holding and using information), and cognitive flexibility (effectively switching between tasks; Diamond, 2016; Miyake et al., 2000; Zelazo et al., 2013). Another brain based teaching strategy is building students' executive function. The executive function is an amazing ability to consciously control humans' thoughts, emotions and actions in order to achieve goals. Neuroscience helps the educators' understand the students' brain work, their strengths and weaknesses so it can help educators understand them. The brain is plastic and can be shaped, changed and grown. Research has shown when students understand and believe they can change their brains and grow their intelligence they work harder, persist through struggle and make greater achievement (Botwania and Saniewka, 2016; Rukminingsih, 2018 and Parr, 2016). Brain based teaching strategies to help build executive function developed by Caine & Caine (1990, 2012), Jensen (1996), Sausa (2001) and Chevalier (2015). Certain areas of the brain can be developed by activating students' executive function which are responsible for working memory and emotional control.

As the brain grows and develops, it is ready for different types of learning. This principle applied in the industrial age and the information age, and it applies today in the digital age, or the so-called conceptual age. Their brains have adapted quite well to the high-tech world, and pandemic Covid 19 forces the education to implement full online learning. The use of technology is implemented in all schools in Indonesia. Adult learners utilize inhibition to rally their attention with various tasks in various online platforms both synchronous and asynchronous such as using Google classroom, telegram and zooming. Working memory entails simultaneously storing and processing the information. In reading comprehension, for example, students have to activate students' content schemata on the same topic with the text they read, bring to the forefront of their memories of the background knowledge, use all the information to comprehend the text easily. Cognitive flexibility lets students manage the learning activities in classrooms. Cognitive flexibility enables students to make agreement with the teacher or lecturer in their classroom activities while course outline is made (Zewelanj, 2016, and Chevalier 2015)

### **METHODS**

This study was quantitative factorial because it had two factors and each factor had two levels, participants 2 x 2 factorial design (Ary, et al., 2010). The sample was taken from students who were taking Critical Reading course from two different classes of an English department in one of private college in Indonesia. The participants were 76 students involving

38 students for the experimental group and 38 students for the control group. There are three variables in this study, namely two independent variables (brain based teaching strategies by building executive function with technology support and online instruction with flipped classroom as a conventional teaching strategy. Then the moderator variable was students' reading motivation and the dependent variable was students' reading achievement.

The instruments used in this study were motivation reading questionnaire and reading comprehension test. The questionnaire was used to measure students' reading motivation level to classify students into high and low levels of reading motivation. The questionnaire with Likert scale in which the questionnaire was designed with related indicators of students' reading motivation. The reading motivation questionnaire aimed to classify students with high and low levels of reading motivation. Reading comprehension test was used to assess students' achievement in EFL reading comprehension. The analysis of data had been used in this research was two-way Analysis of Variance (ANOVA) at level of significance  $\alpha = 0.05$ . It was used to test the three hypotheses. Before applying the two-way ANOVA, there were two requirements namely the normality and homogeneity of the test should be fulfilled. Normality was tested by using Lilliefors- test and homogeneity was tested by using F – test and Barlet – test. The test aimed to test research hypotheses.

## FINDINGS AND DISCUSSION

The findings are presented in two sections to answer the research questions. First, the summary of data description is presented in table 1 and the second, Summary on calculation result of two -way ANOVA data is presented in table 2.

Table 1. Summary of data description

Statistical Values	A1	A2	B1	B2	A1B1	A1B2	A2B1	A2B2
N	38	38	38	38	19	19	19	19
Highest score	37	34	93	71	37	29	33	29
Lowest score	20	20	20	20	20	20	20	20
Mean	28.08	26.89	81.63	63.68	31.63	24.58	26.58	25.58
Median	28.00	27.50	80.00	64.50	31.00	25.00	26.00	26.00
Mode	28.00	28.00	76.00	64.00	30.00	27.00	32.00	29.00
Standard deviation	4.54	4.09	5.62	4.39	2.73	3.06	4.35	3.06
Variance	20.57	16.69	31.59	19.25	7.47	9.37	18.92	7.37

Notes:

A1 : group of students taught by using brain -based teaching strategies by building executive function with technology support

A2 : group of students taught by using online instruction integrated with flipped

- Classroom
- B1 : group of students with high motivation
- B2 : group of students with low motivation
- A1B1 : Group of high motivation taught by using brain -based teaching strategies by building executive function with technology support
- A1B2 : Group of low motivation taught by using brain -based teaching strategies by building executive function with technology support
- A2B1 : Group of high motivation taught by using online instruction integrated with flipped classroom
- A2B2 : Group of low motivation taught by using online instruction integrated with flipped classroom

The following is the summary of the two -way ANOVA computation which contained the variance related to the score of means, teaching strategies, students' motivation, interaction, error, and means of treatment. By looking at this description of the analysis of variance, it is easier to take into account the analysis related to two-way ANOVA as shown in the following.

Table 2. Summary on calculation result of two - way ANOVA

Variance	Dk (Df)	Sum of squares	Mean square	F observed	Ft A ( $\alpha$ )=0.05
Teaching strategies	1	308	308	27.32	3.98
Students' motivation	1	78	78	6.92	3.98
Interaction	1	174	174	15.43	3.98
Error	72	812	11.27	-	-
Means of treatment	1	557155	-	-	-
Total	76	57155	-	-	-

This summary on computation results of the two-way ANOVA could be used to verify or to describe testing hypotheses. By considering the idea of the above table, it could be related to the testing of hypotheses. Based on these testing hypotheses, it could be concluded that hypotheses were really verified. The value of observed F exceeds the value of F from table in the three variances (teaching strategy (27.32), motivation (6.92), and interaction (15.43) whereas the value of F from table was merely 3.98 for three variances. It could be seen that the three hypotheses were verified at alpha 0.05, as the first hypothesis is that the students' achievement in reading comprehension taught by using brain based teaching strategies by building executive function with technology support was higher than those taught by using online instruction integrated with flipped classroom strategy was really true; the second hypothesis is that the students' achievement in reading comprehension with high motivation got higher than those low motivation was really true; the third hypothesis is that there is an interaction between teaching strategy and students' motivation level in reading comprehension was really true.



Based on the finding, it can be concluded that students' achievement in Reading Comprehension by employing brain based teaching strategies by building executive function, there is a great increase in conceptual understanding after the implementation of online based-instruction based on brain based teaching in Reading comprehension class. Pourhosein (2014) and Chevalier (2015) stated that using technology can create a learning atmosphere centered around the learner rather than the teacher that in turn creates positive changes. Caine & Caine, 2016; Rukminingsih, 2018; and Zewelani, 2016) have stated that building executive function can lead the students to change their brains and grow their intelligence. They work harder, increase their spirit and make greater achievement in their reading comprehension.

The strategies of brain based teaching by building executive function with supporting technology are involving (1) creating a positive emotional environment in online classroom, (2) providing opportunities to apply learning, (3) introducing activities to support developing executive function and prior knowledge activation and transfer opportunities, (4) employing model higher thinking skill which adapted from Caine & Caine, 2016; Sausa, 2001 and Handayani, 2020).

By employing online instruction, such as in Google classrooms, teachers can use feedback loops to find out whether the students' perception matches their expectation. This step is used to organize information in the brain at different levels. Students must transform information as their own learning with the use of working memory and prior knowledge to form long-term allow students to use the information into different products that can become a trigger for conceptual understanding. Handayani (2020); Ramakrishnan, & Annakodi (2013) and Rukminingsih (2018) found that teachers should make use of brain based teaching strategy and the concept of brain based learning in the classroom.

## CONCLUSION

Based on findings and discussion that brain based teaching by building executive function had a statistically significant influence on the students' reading achievement and motivation. Based on finding and discussing, brain-based teaching strategies by building executive function with technology support had three conclusions. The students' achievement in Reading Comprehension taught by using brain based teaching strategies by building executive function with technology support is effective. There is statistically significant influence on the students' motivation and achievement in Reading comprehension. There is an interaction between teaching strategy and students' motivation level in reading comprehension.

These findings of this study confirms existing empirical evidence dealing with brain based teaching strategies which have been implemented by building students' executive function with technology support in one of private college EFL students in Indonesia. These findings have the following pedagogical implications for current and prospective English teachers and lecturers, students and educational authorities it is great significance that to provide teachers and lecturers with some knowledge in which they can make the students motivated and get a good achievement in full online learning by considering how their brains work and learn by implementing brain based teaching strategies. Building students executive function stimulates students to have good emotion, positive climate in an online class environment and strengthen their cognitive skills especially in EFL reading courses. There is a growing need to understand more about brain based teaching strategies in foreign/second language learning; therefore, it is hoped that this study will contribute to the bank of knowledge regarding students in EFL reading classrooms and to encourage further studies on brain based teaching strategies with technology support.

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