

## Effects of English Medium Instruction on Developing Executive Functions of Students

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### Abstract

The process of globalization made countries undergo the process of implementing educational programmes in English in order to increase their competitive advantage. The Russian Federation is not an exception. English as Medium of Instruction (EMI) is one of the instruments that can help to acquire English in different professional fields and nurture the work force that can promote Russian science, education the international market. Moreover, EMI is effective for fostering executive functions, specifically cognitive skills. This paper is devoted to the research of EMI influence on student's executive functions. The hypothesis of the experiment states that EMI is beneficial for advancing inhibitory control and working memory of a person. We designed two modules for teaching Economics and Information Technologies in English which we are implementing in two university groups. To see the results of the study students are to take pre-tests and post-tests on the level of English proficiency, inhibition, mental flexibility, verbal fluency and working memory. At the end of the experiment we will use a statistical analysis to process the results to find out if the hypothesis of the study is true or false.

**Key words:** English Medium Instruction, bilingual education, executive functions, neurolinguistics, higher education.

### 1. Introduction

English is lingua franca, it is the language of science, communication, it is spread everywhere, and it will not be replaced soon. English Medium Instruction (EMI) is a relatively new phenomenon, and the discussion about it is extensive in the literature. Scholars argue about the need of English as Medium of Instruction in higher education, and there are at least three groups distinguished. The first group considers EMI to be an innovative approach that can be beneficial for individuals, universities, companies, countries, etc. The second group are sceptics who see English as a way of eliminating their native languages. The third group neither for, nor against EMI due to various factors, one of which is indifference to the new approach. Nevertheless, the popularity of EMI is growing. There may be multiple reasons to implement EMI in higher institutions, but the main one is about universities' desire to be in educational ranking lists. Institutions of tertiary education pursue the goal of being on a higher level of a prestigious ranking list, so that they can be more competitive on the educational market, can have more international students and teachers, can prepare more efficient educational programs. Therefore, eventually universities have to adopt programmes and courses in English due to internalization and globalisation.

In 2014 Julie Dearden published the report on EMI research in other countries. According to the report's findings, "22 out of 55 countries surveyed (40 per cent)" responded on the existence of EMI policies, and "27 out 55 countries (49 per cent) reported that official statements concerning EMI had been made publicly available" [4]. In 2018 the number of the countries, which have implemented EMI in the curriculum, must be higher. These findings mean that EMI is a "global phenomenon" [4] and its popularity is growing fast. Russian Federation, as well as other non-English countries, are eager to level up their education systems, consequently, different English-language programmes are being implemented.

Klarrisa nad Rainer Lueg [6] conducted a study on students' interests in EMI. The results of the study showed that "students generally see EMI as a personal enrichment and as a boon for their future careers". Therefore, EMI is intriguing not only to universities, but to individuals who are striving for personal development. Thus, English Medium of Instruction is a need, however, the question is how to organize its implementation in higher institutions. EMI researchers, such as Julie Dearden, Ernesto Macaro , Katherine Ackerley, Marta Guarda, Francesca Helm , Elena Frumina and Richard West, etc., analyse the challenges that higher institutions face in the process of adopting EMI. The issues include a lack of EMI specialists, resources, clear comprehension of EMI methodology and theoretical basis in order to practice this approach.

As much as we are concerned about EMI beneficial effect on improving the level of English proficiency, we are seeking to investigate if learning through EMI approach has an impact on the development of executive functions of the students, particularly, inhibitory control, verbal fluency and working memory. The development of executive functions is vitally important as they help us plan, organize, make strategies, pay attention, remember details and manage time and space. Practically, evolving executive functions means evolving our life, personality and future.

Inhibitory control is "the capacity voluntarily to inhibit or regulate prepotent (i.e., strong or automatic) attentional or behavioral responses" [8]. The examples of inhibition include life issues such as stopping yourself from eating chunk food, make yourself get up in the morning to go to school or work, learn complicated things (new content, complicated phenomena, etc.). Verbal fluency commonly refers to the speed of speech. Working memory is the ability to hold information in mind and use it to complete a task.

Therefore, our research is devoted to the study of EMI methodology. The hypothesis implies that English Medium of Instruction is beneficial for developing executive functions of the students. To understand EMI approach and prove the hypothesis we are to analyse the background of EMI, theoretical basis, methods and techniques of practicing EMI in class, to design EMI modules on the basis of those methods and techniques and to conduct an experiment. At the end of the research we will design a model of EMI implementation.

## 2.Methods

The study began from researching the literature on EMI methodology. The findings happened to be tenuous as there is still no clear description of the methodological basis. However, some scholars consider EMI to be related to CLIL (Content and Language Integrated Learning) approach. Nevertheless, J. Dearden [4] compared CLIL and EMI and provides the features in which these two approaches differ. First of all, she says that EMI, unlike CLIL, has no specific contextual origin. Secondly, the language of education in EMI approach is English, whereas CLIL programmes may be designed in any language. Thirdly, CLIL has an aim of developing both content and language, and EMI does not have this objective. To a great extent EMI is also focused on teaching a subject matter, rather than language. However, EMI is a bilingual approach which means that a language is part of the learning process in any circumstances. Consequently, EMI and CLIL differ in terms of language acquisition and context, but not in methodology. Leastwise, J. Dearden did not give any information on this issue. Therefore, we can make an assumption that EMI and CLIL resembling methods and techniques, except the fact that EMI is content-driven.

As EMI is content-driven, it implies learning a discipline through English. There is no need to say that this kind of studying take a lot of students' work, especially cognitive one. To understand a sphere of study (Chemistry, Biology, Informatics, etc.) learners are to develop high level of language proficiency which is called Cognitive Academic Language Proficiency (CALP). Acquiring CALP means that learners need to activate their high-order thinking skills among which are analysis, synthesis and evaluation, according to Bloom's taxonomy. Individuals develop these skills by training their brain evolving their

executive functions or, in other words, by evolving their executive functions. Thus, we believe that EMI helps students to advance executive functions and develop Cognitive Academic Language Proficiency.

The next step of our research is to hold the pedagogical experiment which will demonstrate if the hypothesis is true. For this procedure we have designed two EMI modules (“Information Technologies” and “Economics”) and implemented it in three groups of students from Kazan Federal University. We are going to train executive functions through delivering classes in English, the level of which is above the proficiency level of students. To help them learn the content we will provide scaffolding, translanguaging techniques, as well as techniques and methods for developing critical thinking, memory, attention, etc. The number of students totals 43 individuals. To trace the progression of executive functions and the level of Cognitive Academic Language Proficiency the students are to take pre-test and post-test which consist of three types of test – tests on executive functions (inhibition, mental flexibility, verbal fluency and working memory), the level of English proficiency and the knowledge of content (Information Technologies and Economics).

For measuring the level of English proficiency we chose DIALANG test which had been developed by Lancaster University. DIALANG happened to be the only online free test which is relevant for our study as it corresponds to Common European Framework of References for languages and gives more accurate results. To examine the knowledge of disciplines we chose simple tests on Economics and computer literacy.

The executive functions, which we are going to analyse (inhibitory control, verbal fluency and working memory), are to be measured by Trail Making Test (TMT) form B, Verbal Fluency Test (VFT) - F, A and S and Stroop Test.

The Trail Making Test was introduced in 1938 by Partington [9]. It was used in 1944 for assessing general intelligence, and was part of the Army Individual Test of General Ability [10]. The Trail Making Test is now commonly used as a diagnostic tool to examine brain impairments. The executive function measured includes mental flexibility, particularly attention, mental engagement, motor dexterity, and working memory, ability to execute and modify a plan of action, and ability to maintain two trains of thought simultaneously. Form B implies that a participant is to draw lines to connect circled numbers and letters in an alternating numeric and alphabetic sequence (i.e., 1-A-2-B, etc.) as rapidly as possible [9].

The Verbal Fluency Test (VFT) - F, A and S evaluate verbal ability and executive control. In this test participants are to say as many words as possible, within a period of 60 seconds, that begin with letters F, A and S. The total score consists of the sum of all correct words beginning with the three letters. Participant cannot use proper names and words with the same stem. Participants are to retrieve words of a foreign language, which requires them to access their mental lexicon, select relevant words and avoid repetition. Poor performance in the task show deficits in verbal ability and executive control. Therefore, fluency tasks can be used as an efficient instrument of examining verbal functioning [12].

The Stroop Color and Word Test (SCWT) assesses the ability to inhibit cognitive interference (inhibitory control), which occurs when the processing of a stimulus feature affects the simultaneous processing of another attribute of the same stimulus [5]. The test is very sensitive to subtle changes in brain function that affect attention – so lack of sleep, fatigue and minor brain injury may increase the time spent on the test. The test consists of two parts. First, participants require to read the words (Picture 1). Then, in the second part participants need to name the ‘ink colour’ of a ‘colour word’ (Picture 2).

Picture 1. Congruent Condition Test 1

GREEN	WHITE	PURPLE
BLUE	RED	GREEN
PINK	ORANGE	BLUE
PURPLE	YELLOW	GREY
RED	GREEN	ORANGE
BLACK	BLUE	RED
WHITE	YELLOW	PINK

Picture 2. Incongruent Condition Test 2

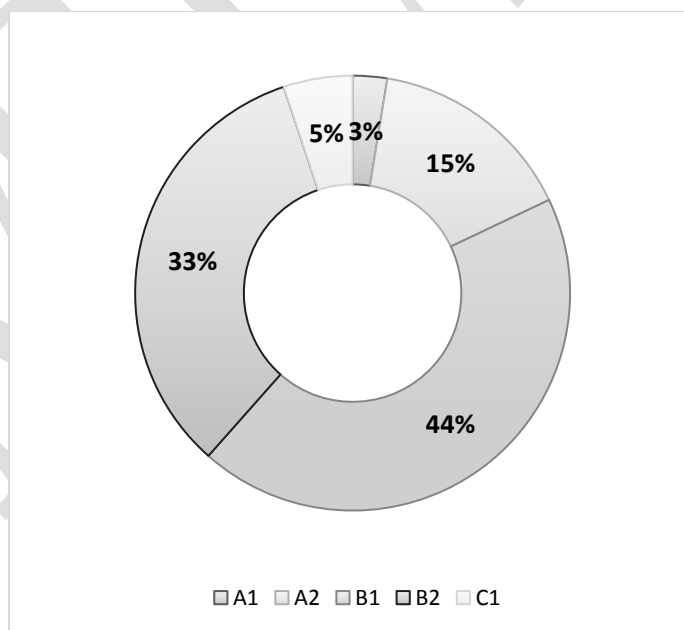
GREEN	WHITE	PURPLE
BLUE	RED	GREEN
PINK	ORANGE	BLUE
PURPLE	YELLOW	GREY
RED	GREEN	ORANGE
BLACK	BLUE	RED
WHITE	YELLOW	PINK

**3.Results and Discussion**

The aim of the study is to infer if the experimental exposure (implementing EMI modules) is effective. The hypothesis presumes that the experimental exposure of EMI approach is advantageous for advancing executive functions of the students and the level of CALP in English.

The results of DIALANG pre-test showed that the overall proficiency the prevailing level of 43 students is B2. You can see the results in Diagram 1.

Diagram 1. The levels of language proficiency in the experimental group.



The results of the pre-test of Trail Making Test (TMT) Form B showed that the average time to fulfil the test equals 68.04 seconds (Table 1). The students who completed the tasks faster than the others scored 24 seconds and the slowest one scored 125 sec (2 minutes 5 second).

**Table 1.** Results of the TMT Form B

	Average	Deficient	Fastest
<b>Form B</b>	68.04 sec	125 sec	24 sec

The pre-test of Verbal Fluency Test (VFT) - F, A and S demonstrated that the average number of words remembered in 60 seconds equal 18.68 words (Table 2). The highest score in groups equals 30 words, and the lowest one - 12 words.

**Table 2.** The results of the VFT (F, A, S)

	Average	Lowest score	Highest score
<b>F, A, S</b>	18.68 words	12 words	30 words

The pre-test of the Stroop task includes two tests. The first Congruent Condition test measures reading speed of the learners without any incongruent interferences. The average time on completing the task equals 7.788 seconds (Table 3). The students who completed the tasks faster than the others scored 10 seconds and the slowest one scored 6 seconds. The second Congruent Condition test measures reading speed and inhibitory control of the learners by interfering with incongruent items (the color of the word). The average time - 25.252 seconds. The slowest students scored 44.4 seconds, the fastest one - 14 seconds.

**Table 3.** The results of the Stroop test

	Average	Deficient	Fastest
<b>Congruent Condition Test 1</b>	7.788 sec	10	6
<b>Congruent Condition Test 2</b>	25.252 sec	44,4	14

#### 4. Summary

The presented results contain only the examination of the experimental group in which EMI was implemented as an educational technology. At the end of the experiment we will provide the analysis of pre-tests and post-tests of the both, experimental and control, groups. The findings do not include the control group because the number of the participants may increase in the process of the research.

At the end of the study to verify the hypothesis, the results of the tests will be statistically analysed by means of Student's t-test. T-values of six tests will be calculated: DIALANG test, Trail Making Test (TMT) Form B, Verbal Fluency Test (VFT) - F, A and S, Stroop test and the tests on Economics and Computer Literacy.

#### 5. Conclusion

Currently, we cannot predict any practical results because the research and the experiment are at its opening stage. At the time we can only state that during the preliminary tests the learners felt uneasy because they were afraid of failure, though there was no particular restrictions on the score scales. In fact, there was no pressure at all, but most of the students panicked because the tests on the executive functions implied challenges for them, they had to "activate the brain". Thus, we can say that in real life, the learners resist any challenges and feel nervous when coping with the problems. Therefore, any incongruent stimuli can hold individuals from actions. If the hypothesis is true, students can evolve not only in the learning process, but in their personal lives too.

## 6. Acknowledgement

*The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.*

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