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ABRAHAM LINCOLN BILINGUAL SCHOOL

Effects of a Bilingual Physical Education Program on Fundamental Movement Skills and English Language Skills Children aged 7-9 years

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Abstract

Bilingual Physical Education is an innovative method to promote children's motor development and foreign language learning. Research suggests that the development of motor skills is associated with higher levels of physical activity, and English language proficiency is related to high economic indicators (Salvador, 2017). This research article aims to analyze the effects of a bilingual Physical Education program on fundamental movement skills and English language skills in 12 children aged 7-9 years during 12 physical education sessions oriented in English. Four Physical Education Metrics checklists were used to assess motor skills and the Young Learners Test was used to assess English language proficiency, by a quantitative approach, non-experimental design, longitudinal type, and descriptive scope study. Results indicated improvements greater than 50% in running, jumping, throwing, and catching skills, while 41% increase in English language proficiency in all participants. Consequently, the bilingual physical education program shows a positive impact on motor skills and language skills and contributes significantly to the area of foreign language learning through human movement.

Keywords: Bilingualism, English, Motor Skills, and Physical Education.

Resumen

La Educación Física Bilingüe es un método innovador para promover el desarrollo motor y el aprendizaje de lenguas extranjeras en los niños. Las investigaciones sugieren que el desarrollo de habilidades motoras está asociado con mayores niveles de actividad física, y el dominio del idioma inglés está relacionado con indicadores económicos altos (Salvador, 2017). Este artículo de investigación tiene como objetivo analizar los efectos de un programa de Educación Física bilingüe sobre las habilidades motoras fundamentales y el dominio del idioma inglés en 12 niños de 7 a 9 años durante 12 sesiones de educación física orientadas en Inglés. Se utilizaron cuatro listas de chequeo estandarizadas para evaluar las habilidades motoras y el Young Learners Test de Cambridge University para evaluar el dominio del idioma inglés, mediante un estudio de enfoque cuantitativo, diseño no experimental, tipo longitudinal y alcance descriptivo. Los resultados indicaron mejoras superiores al 50 % en las habilidades para correr, saltar, lanzar y atrapar, mientras que un aumento del 41 % en el dominio del idioma inglés en todos los participantes. En consecuencia, el programa de educación física bilingüe muestra un impacto positivo en las habilidades motrices y lingüísticas y contribuye significativamente al área de aprendizaje de lenguas extranjeras a través del movimiento humano.

Palabras clave: Bilingüismo, Educación Física, Habilidades Motrices, Inglés.

Introduction

The statistics of the Secretary of Health of Bogotá (SDS) in 2017 reported that 7 out of 10 children are sedentary in this city (Secretary of Health of Bogotá [SDS], 2018) which implies that only 3 out of 10 children in Bogotá, complied with the recommendations of physical activity suggested by the World Health Organization [WHO] (Prieto et al., 2015), which results in an alarming fact according to several systematic reviews that affirm that there is a direct relationship between the levels of physical activity, levels of motor development and health status during childhood on adulthood lifestyle (Ávila and Barbosa, 2013; Zeng et al., 2017). This means that, in the situation of Bogotá, the lower the physical activity indices, the less mature the kids have the basic movement skills and the higher the risk of getting a chronic disease like obesity, diabetes, cancer, stroke, or hypertension (Riebe, 2018).

On the other hand, Colombia's English proficiency is classified as low level, according to the largest world ranking made by Education First in 2017, in which Colombia scored 49.97 points and consequently was ranked 51 out of 80 countries in the world as well as 11 out of 15 in Latin America (Education First [EF], 2017). Moreover, only 2% of A calendar students who took the national evaluation test "Pruebas Saber 11" in the 2021 year got a B1 level, while 47% of them, got an A- level classification, which is the lowest level that someone can reach in this test (ICFES, 2021). These statistics indicated an alarming situation for Colombia regarding second language skills and world development indicators because it has been determined by EF that a high command of English is related to higher income, higher quality of life, greater ease of doing business, and greater innovation (EF, 2017).

This research project was originated due to the information found in some papers (EF, 2017; SDS, 2018; Prieto et al., 2015; Ávila and Barbosa 2013; ICFES, 2017), which suggests a trending lack of physical activity, immature state of basic skills of the movement and the low level of English proficiency of children located in Bogotá, which means that to change the current low physical activity levels and foreign language results it becomes relevant to implement transdisciplinary strategies or policies that could increase those abilities (Salvador, 2017).

Physical Education classes in the school might provide a positive impact on physical fitness and cognitive performance, like short- and long-term memory. Nevertheless, few studies have been focused on the possible effects of bilingual physical education programs on the motor skills and second language learning process

(Suraya et al., 2020). Most of the research on this matter has been focused on the effects of physical activity on vocabulary acquisition, there are only few ones which are analyzing deeper aspects of language competences, such as listening, writing, and reading (Suraya et al., 2020).

This project has been focused on developing motor and English skills through a bilingual Physical Education program, based on the results found in the curricular integration of Physical Education and English areas in European countries, as described by Salvador et al. (2017). Verifying the possibility of learning a language through body movement in childhood (Mavilidi et al., 2015; Griva and Semoglou, 2012); and considering the reports of the correlation between physical activity and the functioning and structure of the hippocampus, mentioned by Suzuki & Fitzpatrick (2015) and Mårtensson et al. (2012).

Theoretical framework

The bilingual physical education program is based on the European methodology called Content and Language Integrated Learning (CLIL) which has been applied in bilingual centers around the world and has obtained excellent results in promoting the learning of the foreign language through the curricular subjects (Morales et al., 2017; Mcdougald, 2015; Fazio et al., 2015). This project might be considered a Low-intensity CLIL program because physical education was the only subject used for enhancing bilingualism; nevertheless, studies have shown that High-intensity CLIL programs improved student's overall proficiency in a foreign language at a higher level. The areas that usually support this process are science, arts, math, social studies, and PE (Gil et al., 2021).

Materials and methods

Sample

12 children participated in this research (8.25 ± 0.45) years old, 3 male and 9 female, the sample size was determined through Epi Info software with a 95% of the confidence interval, in which the inclusion criteria were to be a healthy Colombian student aged between 7 and 9 years old, plus, another exclusion criterion, to take intense extracurricular classes of sports or English language during the intervention.

Design of experiment

The study design is non-experimental, carried out without manipulating the variables; additionally, the type of design is longitudinal because the data is collected in two stages in order to analyze changes through the time; moreover, the approach is quantitative for the reason that magnitudes are measured; and finally, the scope is descriptive in view of the fact that it relates the details of the phenomenon (Hernandez et al., 2014).

Stages of the program

The bilingual Physical Education intervention program is divided into three practical stages. The first one is called "Initial diagnosis", in which the first process of evaluation of movement skills and the English language is registered (Couturier et al., 2014).

The second stage is called "Skills construction", this stage had 4 didactic units with 12 classes in total, each unit was designed for working on a motor skill like running, jumping, throwing and catching while communicating all the information in English as the official Language, it means that each unit was composed by 3 lessons, which lasted 45 minutes, including physical activities, games, drills and challenges as main contents, which could give students the chance of learning the specific topics of the subject related to motor skills but at the same time, practicing the foreign language (Magdaleno, 2011).

In addition, the third stage called "Exit test" is established, this comprises the final motor and linguistic skills evaluation to verify the evolution of the variables. Finally, the data found is analyzed and conclusions are established (Couturier et al., 2014).

Evaluation tools and tests

To obtain the data of the selected sample in the initial diagnosis and exit test, two internationally validated evaluation tools were used to accurately estimate the status of the variables to be studied, the general information about them is described as follows.

For assessing motor skills a Physical Education teacher uses a set of checklists prepared by the "American Society of Health and Physical Educators" published in 2018. Each instrument describes some key elements that a mature movement ability should have; consequently, it works as a verification list of the presence or absence of these items in the motor execution. Four checklists are selected for evaluating the running, jumping, throwing, and catching patterns (Chepko et al., 2018).

On the other hand, for assessing foreign language skills, an English teacher uses the international questionnaire "Young learners" published by Cambridge University in 2019, which is composed by 20 questions in total and lasts approximately 30 minutes, this in only one English test which assesses reading, writing, and listening skills on a beginner level, described as an A1 level in the Common European Framework of Reference (Cambridge University, 2019).

Increase percentage is analyzed as follows:

$$C = \frac{X2 - X1}{X1}$$

Where C represents the relative change, X1 the Initial value and X2 the final value.

Rule of three is applied as follows:

$$x = \frac{b \cdot c}{a}$$

Where x represents the unknown value, and b, c, the known values.

Results

Table 1.
Anthropometric characteristics of the population.

Anthropometric Characteristics	Subjects				
	Age	Grade	Weight	Height	BMI
Average result	8.25 ± 0.45	4th	25.75 ± 2.09	1.23 ± 0.06	17.09 ± 1.12

Source: Prepared by the authors.

These details indicate that students follow normal growth patterns, none of the participants has an overweight or malnutrition condition, which reduces the risk of getting a chronic disease (World Health Organization [WHO], 2022). Furthermore, the sample was in the stage of development of basic movement skills like running, jumping, throwing, and catching, which is from 7 to 11 years old (Haibach, 2011).

Table 2.
Scores of the motor and English skills assessments.

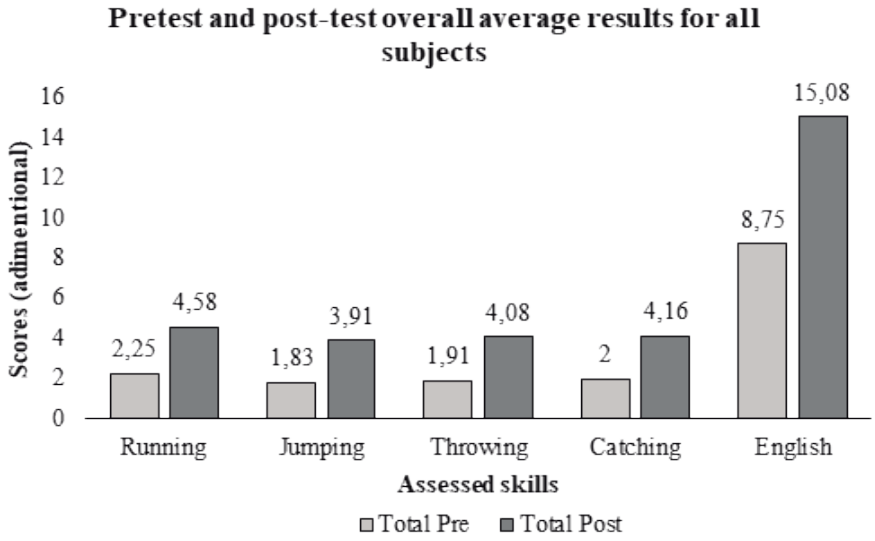
Assessments	Skills									
	Motor								English	
Variable	Running		Jumping		Throwing		Catching		Reading, listening, writing	
Subject	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	2	4	2	3	2	4	1	3	9	15
2	2	5	2	5	2	4	3	5	8	14
3	3	5	2	4	3	5	2	5	9	15

Subject	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4	2	4	2	4	2	4	2	4	7	14
5	2	4	1	3	1	3	2	4	8	14
6	2	5	2	4	2	5	2	4	8	15
7	2	4	2	4	2	4	2	5	9	16
8	2	5	2	4	1	3	2	4	7	14
9	3	5	2	4	2	4	2	5	11	17
10	3	5	2	5	2	4	2	4	11	17
11	2	4	2	4	2	5	3	4	8	14
12	2	5	1	3	2	4	1	3	10	16

Source: Prepared by the authors.

Table 2 shows the results that each one of the 12 students scored in the four Physical Education Metrics checklists and the Young Learners test used for assessing the motor skills and English proficiency before and after the bilingual physical education program. The lowest grade possible for fundamental skills is 0 and the highest is 5. Moreover, in English proficiency, the lowest score is 0 and the highest one is 20. After calculating the overall average of each skill, the relative change evidenced through time with the application of the bilingual physical education program on the basic skills of movement and on the linguistic skills of the population.

Figure 1.
Pretest and post-test overall average results for all subjects



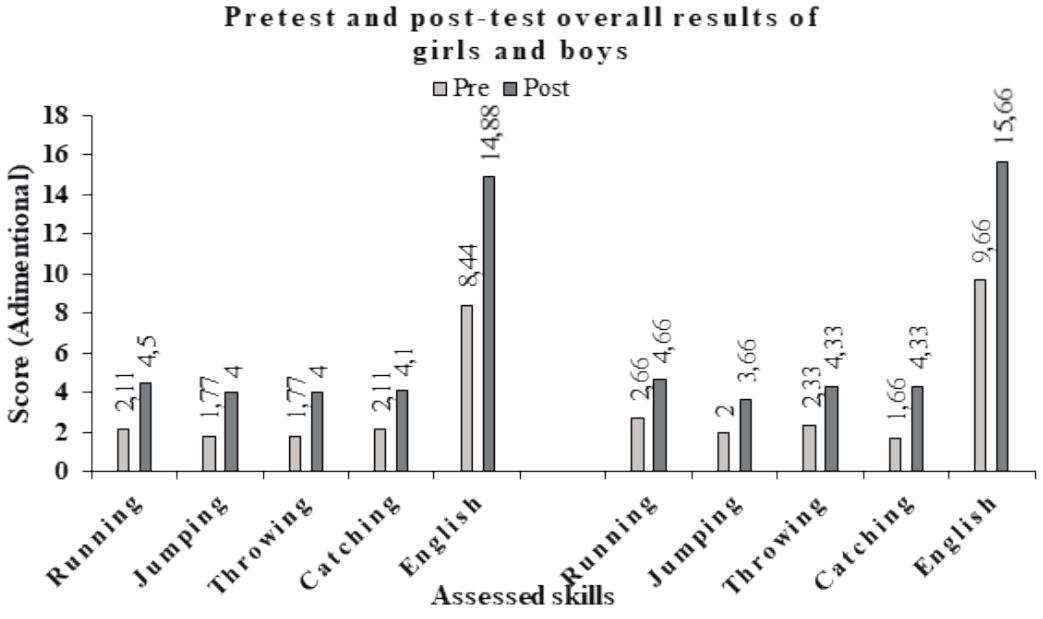
Source: Prepared by the authors.

Figure 1 indicates that all basic movement skills obtained an overall average improvement of over **50%** posttest in comparison to the results of the pretest; in the running, jumping, throwing, and catching motor abilities, there were relative changes of **50.80, 53.84, 53.18 and 51.92%** consecutively, in which the motor skill jumping obtained in average the lowest results, however, it reaches the highest percentage increase of all physical skills. And finally, running motor ability obtains the highest results in the pretest and posttest of the total sample, but it reaches the lowest percentage increase of all physical skills.

Moreover, in the English language skills, the percentage increase is **41.97 %.** Applying a rule of three in math as explained before, where it can be affirmed that in the pre-test results the lowest score was 7/20 and the highest one was 11/20, which means that the percentages of proficiency in the CEFR A1 level were between **35% and 55 %.** In the post-test results, the lowest score was 14/20 and the highest one was 17/20, which means that the percentages of proficiency in the CEFR A1 level were between **70% and 85%.**

Through the results of the bilingual physical education program, it was found that there is a positive association between physical activities and English language learning and might be related to the production of a protein called brain-derived neurotrophic factor stimulated by the physical activity, which helps to regulate synaptic plasticity, being fundamental for learning and memory (Suraya et al., 2020), highlighting the relevance of movement to strength communicating and interacting skills with peers in a foreign language through a fun, motivating and supportive way (Gil et al., 2021)

Figure 2.
Pretest and post-test overall results of girls and boys



Source: Prepared by the authors.

Figure 2 indicates that similar patterns on each skill are observed in both genders, which is related to what Goodway (2010) reported, suggesting that there is no predominance by gender in motor skills development, however, girls obtained higher percentages of improvement compared to boys in linguistic competences and in the basic skills of movement, except in catching. After the intervention, in the group of girls, it was observed that the motor skills that showed the least degree of development were jumping and throwing, while, running was the skill with the highest degree of development; although, in the group of boys, it can be affirmed that the motor skill that presented the least degree of development was jumping while catching and throwing showed a higher degree of development.

Gender differences in structure are generally minimal until puberty, and thus motor development and learning differences between girls and boys before adolescence are likely to be largely influenced by environmental constraints or individual challenges that encourage or discourage the development of skills (Haicach et al., 2018). Research has shown that the positive effects of physical activity on foreign language learning are similar for children and adults either male or female as evidenced in this paper (Suraya et al., 2020).

Discussion

Based on the results provided by the assessment tools and previous studies on the same matter, 3 articles of systematic reviews were considered, published between 2007 and 2020, in English and Spanish, plus 35 reviewed papers, which were found in electronic databases like PubMed, Scopus, Elsevier, EBSCO, Science Direct, Google scholar and ResearchGate (Gil et al., 2021; Salvador et al., 2017; Suraya et al., 2020). Key findings of these previous papers were extracted by Nvivo software, and the details were classified in 4 codes: Bilingualism, Bilingual Physical Education, Relationship between variables, and Recommendations.

Bilingualism

Reviewing the content of elementary school subjects and learning a foreign language at the same time, has become innovative in education, giving raise to programs like content-based instruction, bilingual initiatives, language X as a medium of instruction, game-based projects, and others. Nevertheless, Content Language Integrated Learning (CLIL) is one of the most used and robust schemes in Europe, being confirmed by a higher rate of success at developing speaking and writing skills as well as learning outcomes related to subjects like mathematics, science, geography, arts, and Physical Education than traditional teaching methods (Merino & Lasagabaster, 2015; Gil et al., 2021). Educators had studied the effectiveness of physical activity for learning a second language with modern approaches like Total Physical Response (TPR) program which is a set of physical methods for developing language skills in early childhood (Suraya et al., 2020).

Bilingual Physical Education

Previous evidence shows that the bilingual Physical Education program had a positive influence on the motor skills and language skills of the English language; (Coral et al., 2016) found in Spain, that better results in the English foreign language were obtained in schools that implemented the CLIL program with bilingual Physical Education; (Mavilidi et al., 2015) found in Australia, that the group of students who tried to learn new words by practicing full- body exercise obtained the highest results, and their performance was much better in the immediate and delayed retention tests than the control and segmental movement groups. Besides that, Physical Education as an elementary school subject promotes an ideal learning environment, by encouraging communication and interaction among students to improve output skills, and foreign language does not turn out to be a negative factor which implies reducing the subject topics (Gil et al., 2021)

Bilingual Physical Education can lead students' interest and motivation for learning a second language due to the different, playful, and attractive way that is introduced, which creates an effective platform for learning a foreign communicative skill (Magdaleno, 2011; Salvador et al., 2017); additionally, the influence of physical activity has been recognized to stimulate brain activity, improving the daily learning of children (Meijer et al., 2020; Gil et al., 2021), plus its positive effect on short-

term and long-term memory in the acquisition of vocabulary, leading an increase of implementation of new similar programs (Suraya et al., 2020).

Relationship between Physical Education and Foreign Languages

It has been suggested that there is a positive association between physical activity and the learning process of a new language (Suraya et al., 2020); according to Iverson (2010), motor skills are potentially relevant to language development because they provide opportunities to practice and to acquire vocabulary. In terms of neuroscience, a brain region called the hippocampus is related to physical abilities; this area has a major role in forming short and long-term memories. Considering what was stated by (Suzuki & Fitzpatrick, 2015), when physical activity is performed, the brain undergoes immediate changes, which predispose it to learn, by creating new structural cells and improving memory factors (Mårtensson et al., 2012)

While physical activity is executed, a protein called Brain-Derived Neurotrophic Factor is released, this substance enhances any learning process and makes exercise ideal for acquiring second language vocabulary (Suraya et al., 2020), even though the interaction between physical and cognitive skills is confirmed, there is not a consensus yet about the frequency, intensity, time, and type of physical activity which stimulates the most the foreign language learning process (Salvador et al., 2017).

Recommendations

The coming studies in this area might consider some of these aspects to increase the validity, certainty, and reliability on the research articles:

1. To create a control group apart from the experimental group for contrasting the results (Hernandez et al., 2014),

2. To increase the number of participants and verify gender proportion. (Hernandez et al., 2014),

3. To do a re-test after a couple of weeks to assess the long-term memory learning outcomes in the participants (Suraya et al., 2020).

4. To examine deeper aspects of language like reading, writing, listening, and speaking skills, not only vocabulary acquisition (Suraya et al., 2020).

5. Most research about this topic has been applied in elementary school, the coming studies should explore the effects of bilingual physical education programs in preschool or high school students. (Gil et al., 2021).

6. Europe is the continent with most of the research projects regarding this topic, data coming from other continents like America, Asia, and Africa, might contribute to the construction of innovative programs (Salvador et al., 2017).

7. CLIL methodology has been mainly used for research projects, nevertheless, the studies should examine other alternatives too. (Salvador et al., 2017).

8. More research is needed to assess student's content learning when using CLIL through a foreign language (Gil et al., 2021)

Conclusions

The bilingual physical education program had a positive impact on basic movement skills and English language skills in children aged 7-9 years, observing a high degree of correlation between the state of development of the ability to run and the level of English language proficiency, which means the more mature the running skill is, the better results are obtained in English test.

The effect of the bilingual physical education program on English foreign language skills is 41.97% in children aged 7-9 years, in this way it can be affirmed that body movement can significantly beneficiate the acquisition of new foreign languages since the learning process requires the maximum capacity of the brain, cognitive functions, and regional networks, so that the human being can learn, produce, and understand the conceptual, semantic, morphological, phonological information (Liu et al, 2017). The effects of exercise on the brain are reported in 12 regions, including the frontal lobe, parietal lobe, anterior cingulate cortex, hippocampus, white matter tracts, and functional networks, which turn out to be key for the cognitive process (Valkenborghs et al., 2019).

Considering the findings of previous studies, and the effects seen in this bilingual physical education program can be concluded that integrating movement into cognitive tasks may be beneficial for learning outcomes, due to its neuroscientific stimuli, while physical activity levels of students are not affected at all by the introduction of the foreign language (Suraya et al., 2020). Furthermore, since 2017 the academic production in this matter has increased, 25 new articles have been published regarding bilingual physical education programs, however, none of them were focused under 5 years old students, for that reason, the coming studies should focus on those ages too, not only in elementary school. (Gil et al., 2021)

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