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Bilingual Education and Mathematic Learning in Early Years

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Abstract

In the present article, we analyze the characteristics of bilingual education related to learning mathematics in the early years. When language immersion is implemented while teaching a specific subject such as mathematics, we differentiate between the students' language of instruction and the student's mother tongue. This article delves into the verbal aspect of mathematics and how the language of instruction influences tasks in which the verbal component is essential, such as problem solving. The results shown in the present investigation compares the influence of the language of instruction in 1st and 2nd grade students whose language of instruction coincides with their mother tongue compared to those groups whose language is not coincident. The results show a greater effectiveness in the task executed by the students whose language of instruction coincides with the mother tongue. However, we also observe how this distance tends to be shortened in 2nd grade groups.

Keywords: Second language learning • Content and language integrated learning

Introduction

The focus of Second Language Learning (SLL) has traditionally lied on teaching grammar and syntax through activities. With the implementation of bilingual programs in the classrooms, SLL has evolved to become a natural activity of immersion concentrating on the social and cultural development implicit in language learning. Additionally, it implies that certain curricular subjects are taught in a second language (L2), providing the language of instruction with a leading role and a vehicle to process information when learning.

When L2 command is lower than the first language (L1) proficiency, we should ask ourselves how it will affect the competence development and processing in the subject that is being taught and particularly during the first years of school when the command of both languages is low.

According to the International Bureau of Education, bilingual education can be defined as an educational system in which two languages are used as the medium of instruction. There are many different types of bilingual education, but, on the whole, they can be defined as additive or subtractive instruction. In the additive program, both languages are given equal weight, and they are aimed at developing communication and literacy in both L1 and L2 simultaneously. The subtractive program, however, gives priority to the development of the L2, gradually reducing L1 instruction (Oficina International de Educación-UNESCO, 2016).

Some bilingual programs tend to give more relevance only to language acquisition, whereas others prefer to bring together language acquisition and content learning based on the curriculum. The bilingual programs of the Spanish public schools currently implemented are a good example. Most of these programmes are based on the methodology known as CLIL (Content and Language Integrated Learning), where different subjects are taught in L2.(2021) in a recent study noted that teachers understand and apply CLIL in different ways, with considerable variations between teachers who are more prone to teaching content and those who are more language oriented. In such a situation, it is highly challenging to achieve an adequate balance between language and content, and mainly if teachers do not receive adequate educational training to provide them with the tools to put into practice a real and reliable dual approach in both the language and the content [1].

According to in order for immersion in bilingual education programs to be successful, the following factors must be taken into account [2]

- L2 is the medium of instruction.
- The curriculum based on immersion must run in parallel with the local L1 curriculum.
- There is clear support to L1.
- The program aims at additive bilingualism.
- Exposure to L2 is largely limited to the classroom.
- Students enter school with similar (and limited) levels of L2 proficiency.
- Teachers are bilingual.
- The classroom culture is that of the local community L1 [3].

These factors are not absolutely definite, but the more factors are met, the more chances for the program to be effective. In many cases, although these factors are rarely met, this situation leads to problems that can affect the viability of the program. According to a recent article published in the Spanish newspaper "El País" several educators spoke about the difficulties inherent in the bilingual programs of Spanish public schools stating that many of these factors are not met. As a result, many students have had trouble learning subject contents in L2, leading to a situation where approximately 90 public schools would decide to give up their bilingual programs and change their perspective towards monolingual (L1) education [3].

If we focus on this issue within the field of mathematics, we find authors such as that wonder about using a language different from the mother tongue to teach this matter because the contents learned are not sufficiently independent of language as to be transferred to the students' mental language [3,8].

We must bear in mind that in early years the child's mathematical development learns to represent arithmetic concepts, and if we pay attention to know how they do it, we will see that language development and use is implicit. The numeric awareness is lodged in a series of specialized neural circuits. Some of these circuits recognize digits, others translate them into

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an internal quantity, and others retrieve arithmetic data from memory. The essential characteristic of these networks is their modality, since they work autonomously in a restricted domain, and each one of them is limited to receiving information in one format and converting it into another format [4].

As we can see in Dehaene's triple model, many kids do not find it easy to acquire the concept of number, since it requires the simultaneous activation of several types of representations. To propose a model that allows us to understand this fact better. According to them, the concept of number responds to a triple code model made up of the following components [2,3].

1. Visual code: it recognizes and represents Arabic numbers. For example, the digit "2".

2. Verbal code: it recognizes and represents the verbal form associated to those digits. For example, the word "two".

None of these codes, however, possess semantic information, a piece of information that would be implicit in the third code, that is, the numerical representation.

3. Analogue code of magnitude: this code represents the quantities that provide with meaning the verbal and visual codes. For example, for number two, the analog magnitude code would be (figure 1).

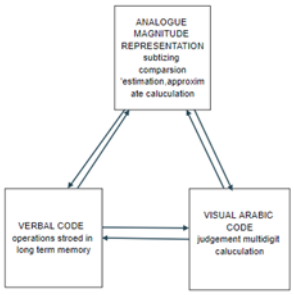

Figure 1. Dehaene triple code model (1992).

According to the fact that a person has numerical and mathematical competencies means having "The knowledge and skills necessary to manage and respond to the mathematical demands of various situations" (p.4).

As we have mentioned before, becoming mathematically competent implies that language should develop in accordance with the development of mathematical concepts, an idea that would lead us to ask ourselves how we could develop bilingual programs so that both L2 learning and mathematical thinking development run in parallel (2021) [1].

In recent research studies, as in [1]. It has been shown that students in their first ages show more difficulties in solving problems when the subject is developed in an L2. However, as it has also been demonstrated in the study as the command of the L2 grows, these differences tend to be shortened (figure 2).

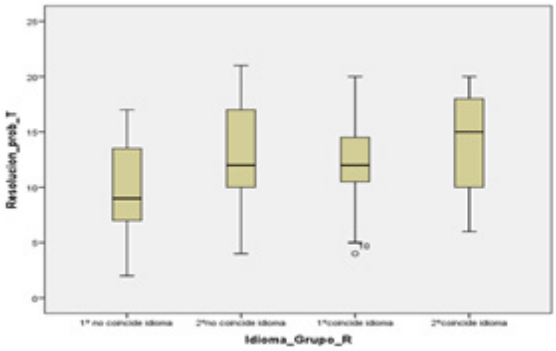

Figure 2. Problem solving x language of instruction x grade.

As we can see, a 1st grade student whose language of instruction matches their mother tongue, their ability to solve mathematical problems is similar to 2nd students whose language of instruction differs from their mother tongue. We can, therefore, observe how problem solving in the early ages is determined by the language of instruction, because when it does not coincide with their mother tongue, the execution level is lower than the situation when the language of instruction coincides. It is also demonstrated how the students, who have been longer exposed to this type of task, as in 2nd grade students, have a smaller difference than 1st grade students with their counterparts when we consider language of instruction as a variable. This may be due to the fact that they have a greater command of the language of instruction, and their longer exposure to problem solving in an L2 has allowed them to build resolution models, which facilitates the task.

Conclusion

The prospect is challenging, and more research is more than necessary to find formulas that would allow finding a balance between the design of bilingual programs and learning of subjects in an L2, in order to enhance benefits and minimize weaknesses.

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