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Relationship Solving Mathematical Problems Focused on the First Grade Equations either Spanish or English in Bilingual Students

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The main idea of this article is to show the relation between students of a bilingual school who solved exercises in English and Spanish, indeed these exercises are focused on the first grade equation, and so it can determine if the mother's tongue is involved by the resolution of a mathematical problem.

Keywords: bilingual; linear equation; learning; correlation

I. INTRODUCTION

In recent years there has been great interest in learning a foreign language and the relevance of this knowledge, Garcia and Garcia (2013) mention the creation and implementation of linguistic policies in Colombia such as the National Bilingualism Plan (PNB) and the Language's Law. Although with different objectives, these two documents are framed in the discourses that, on the one hand, spread the need to handle different languages in a globalised world and, on the other, maintain that it is important to respect linguistic diversity.

Bilingual research in mathematics education has been developing for several years, the works compiled by Barwell (2009), however, when students handle a foreign language and solve all kinds of application problems in the English language, at the time of doing them in their mother tongue generates some confusion due to the change of language. When interviewing four randomly selected students in the sample, it was possible to show that the students preferred to do the exercises in English than in Spanish, the results of the interview can be read in the analysis chapter, based on the above mentioned, Planas and Civil (2010) state that:

> "We have commented on social and linguistic tensions associated with the existence of two languages in the classroom and the organisation of linguistically homogeneous groups. However, we continue to believe that the fact that teachers and students are aware of the tensions, possibilities and viability of using the mother tongue in math class means greater opportunities for participation and learning, can contribute to strengthening the construction processes positive identity and thus create a greater concentration in the classes and improves significant learning in certain areas of mathematics."

Due to the aforementioned and with the results obtained in the research, the foreign language helps the concentration in the classes and a greater understanding of them. However, can a foreign language help students to raise a problem and solve it faster than in your mother tongue?

The article is organised as follows, in sections 2 and 3, you can observe the research methodology and the sample that was selected for this research; in section 4, the results of the investigation and its interpretation are shown, and in section 5, you can observe the conclusion of the investigation.

II. SAMPLE

In this investigation, 40 students (20 girls and 20 boys), students of a secondary school level who are in the grades of ninth, tenth and eleventh were taken as samples, the age of the students participating is between 13-18 years, the men have an average of 15.6 years of age and the women have an average of 15.25 years of age, all 40 students together have an average of 15.4 years of age, the sample selection was type

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non-probabilistic-intentional, as mentioned by Sampieri (2014) in the research methodology book.

III. METHODOLOGY

In the investigation, the instruments that were used for the data collection were through an interview and a test, in the first instance the interview was conducted as it was defined the idea about what was going to be talked about and through an A series of guidelines took place, the interview was conducted with four students, two men and two women, this interview consisted of students arguing how they were doing in math, how they posed a problem in math, this was discussed before applying The tests, after taking the test, were asked, What made the test more complicated in English or Spanish? Why ?, The qualitative analysis of these interviews is annexed in the next section, in the second instance, the tests were applied on different days, they were not simultaneous, first the test was applied in Spanish and then the test was applied in English, both tests were the same only with different languages, then I will see the tests:

English's test:

First question: This formula converts the temperature $°C$ to $°F$:

$$F = \frac{9}{5}C + 32$$

Determine the temperature in $°F$ when it is $30°C$.

Second question: The demand and supply functions for a particular item are given by $D(p) = 14000 - 140p$ and $S(p) = 210p$, where p is the selling price ($) of the item. Using both algebraic and graphical methods, find the equilibrium price for this item.

Third question: A local firm produces and sells boxes. Each box sells for $3. The cost of producing x boxes is given by the function $C(x) = 250 + 2x$, determine the renueve function, $R(x)$.

Spanish's test:

Primera pregunta: Esta formula covierte la temperatura $°C$ a $°F$:

$$F = \frac{9}{5}C + 32$$

Determine la temperatura en $°F$ cuando este es $30°C$.

Segunda pregunta: La función oferta y demanda para un artículo en particular esta dado por $D(p) = 14000 - 140p$ y $S(p) = 210p$, donde p es el precio de venta en ($) de este artículo. Usando métodos algebraicos y gráficos, encuentra el precio que equilibre esta función.

Tercera pregunta: Una firma loca produce y vende cajas. Cada caja es vendida a $3. El costo de producir x cajas esta dado por la siguiente función $C(x) = 250 + 2x$, determine la función de ingreso, $R(x)$.

These questions were taken from the book, Bedding (2007), OXFORD Mathematical studies course companion, were later translated for the test in Spanish. The methodology that will be handled in the research is qualitatively with an interpretative approach, and some results will be presented mathematically since with this approach it is allowed to use this type of interpretation as mentioned in Steven *et al.* (2016).

IV. RESULTS AND ANALYSIS

The results obtained in this investigation allow us to know if the students of bilingual schools type calendar B are facilitated to solve mathematics exercises in English than in Spanish, the result obtained allows us to observe that the analysis that a student executes when reading a text that is not in its mother tongue it allows a greater concentration, but the mathematical knowledge does not vary from language to language, the terms and the thoughts that the students must have developed is the same, in this case it is the numerical-variational thought since the students solve problems with first-degree equations, this can be found in M.E.N (2006) the basic competence standards presented by the M.EN (Ministry of National Education).

Next, the four students presented in the following table mean the common response making by the students when the interview was done:

Table 1. Student's interview

Student / Question	**What was more difficult either english's test or spanish's test**	**¿Why?**
Student # 1	Both	I don't have the necessary math's knowledge and in some questons which was written in english I did not know and the questions that were written in spanish I did not know how to solving the problem or what did I have to do.
Student # 2	Spanish	This test was difficult for me because I did not get cofused when I did it and I think I got some wrong questions, instead the english's test knew its terms and for the IB preparation I practiced a lot with exercises with that approach.
Student # 3	English	I did not know what some words meant so I did not know what to do.
Student # 4	Spanish	I became entangled when replacing in the equation or confused some mathematical meanings that I obsrerved there.

Source: It was made by the author taking into account the interview's results.

Based on the above, we can see that 50% of the students interviewed had a difficult time in Spanish, 25% of those interviewed had a difficult time in English and 25% of those interviewed had a difficult time.

In this instance, we will perform the analysis by correlation of the data, and we will take as reference the time it took to perform the test in both Spanish and English. A table is related to the information:

Table 2. Time of the tests

Time of the test (minutes)	
Spanish	**English**
2	3
1	2
3	1
4	2
5	3
6	2
7	1
1	4
2	2
3	1
1	3
2	2
3	7
1	2
5	7
2	1
3	2
4	1
5	3
1	2
2	2
3	1
1	3
2	2
3	7
1	2
5	7
2	1
3	2
4	1
5	3
1	2
2	3
1	2
3	1
4	2
5	3
6	2
7	1
1	4

Source: It was made by the author taking into account tests' results.

To find the correlation and plot the scatter plot, the TI-Nspire CAS calculator was used. The result obtained in the correlation is 0.040918655278921, rounding it to two significant figures we have that the correlation is 0.041, that is to say 4.1%. Based on this, we can say that the correlation is very low, that is, that there is not much relationship between them. There is a linear relationship between them, which suggests that if the language in which the test is performed influences and taking as reference the regression line (see Figure 1), when one variable increases the other as well and it increases every 0.03 min. Nevertheless, if we find to apply the error margin to this correlation, the property will show that the correlation is null. This implies that the correlation between these variables is none.

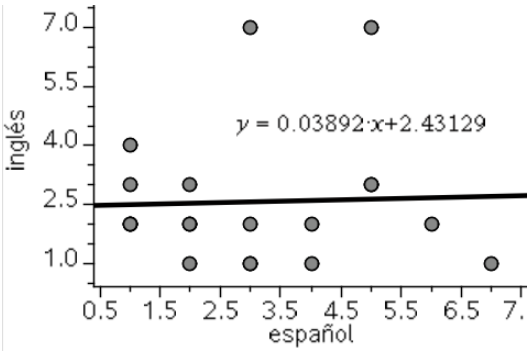

Figure 1. Time's dispersion diagram
(Source: It was made by calculator TI-Nspire CX)

On the other hand, to compare each variable, it makes a bar diagram a box plot. It starts showing Spanish's test:

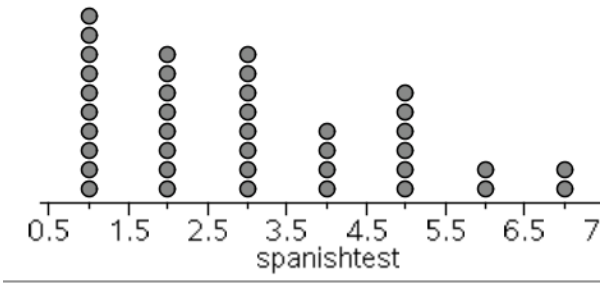

Figure 2. Bar diagram from Spanish's test
(Source: It was made by calculator TI-Nspire CX)

Figure 2 showed that more students spent less than four minutes solving the test. Nonetheless, the number of students who spent more or equal to four minutes did that the statistics was not homogenous. However, the following diagram shows the central position of this test.

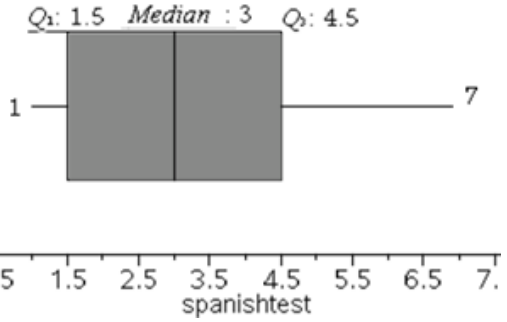

Figure 3. box plot diagram from Spanish's test
(Source: It was made by calculator TI-Nspire CX)

Based on Figure 3, dates are not homogenous, given that 7 minutes is almost atypical data, due to the atypical data of this test starts in 7.5 minutes, i.e. there are students who do not know or do not have the abilities that other students have. Now, it shows English's test:

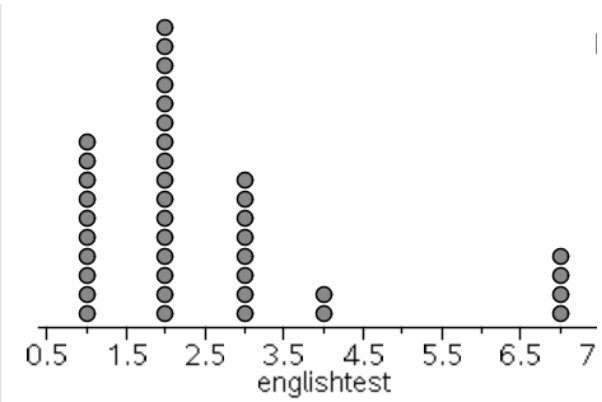

Figure 4. Bar diagram from English's test
(Source: It was made by calculator TI-Nspire CX)

By the Figure 4, as well as happened in English's test, it can see that after four minutes, there are more results, and the difference between Figure 4 and Figure 2 is that more students spent less time taking the English´s test than Spanish's test. However, the following diagram shows the central position of this test.

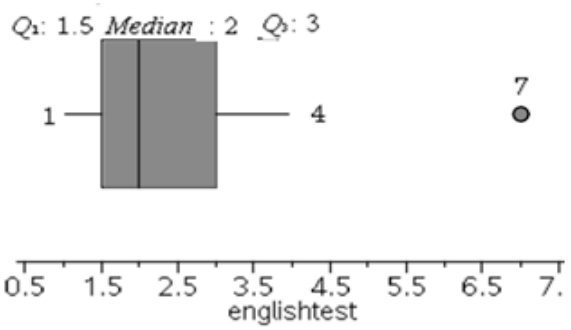

Figure 5. Box plot diagram from English's test
(Source: It was made by calculator TI-Nspire CX)

By Figure 5, this test is more homogenous than the Spanish one (see Figure 3), given that median and quartile 3 are closed to quartile 1. Nevertheless, there is a student who spent seven minutes taking the test and the Spanish's test, but here it is an atypical data. Nonetheless, that result does not affect significantly.

V. CONCLUSION

After analysing the data and obtaining the results, we can conclude that there is a very low linear relationship between the variables, that is, in a way, the language in which a mathematical operation focused on the linear equation in English or Spanish, on the other hand, when qualifying the tests, we observed that some students took longer to solve the problems in Spanish than in English, the test range in Spanish was 6 minutes in the same way as in English, but on average in Spanish took 3.05 minutes and in English, it took 2.55 minutes, the difference is 0.5 minutes, with the above it is verified that if the language influences.

It is very important to develop in students the competencies and skills to solve independent application exercises of whatever language, and a big question is why they took longer to solve the test in Spanish than in English. Although Spanish being their mother tongue and in where most of his high school classes have been developed in Spanish, it should also be noted that many factors such as school environment, affinity with the teacher of mathematics and the disposition at the time of taking the test may have influenced; These are all factors that influence the learning of mathematics regardless of the language in which you are studying. To achieve this objective, technological tools can be used, which allow better learning in students, as did Granados and Padilla (2021) in their research where they showed an improvement in student learning when they used the Geogebra program. On the other hand, poor implementation of these technological tools may result in students not improving their learning process, as Granados (2019) showed in his research where he showed how some thought processes were affected when using the calculator wrongly.

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