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Research article

Teacher expectations and students' achievement in solving elementary arithmetic problems

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HIGHLIGHTS

- There is a moderate correlation between expectations and achievement; expectations are still subject to stereotypes associated with social class.
- We can state that the stereotype associated with gender and mathematics is disappearing among teachers at the levels studied.
- Although teachers have changed over the years and, such as the one concerning the gender of our students, others are maintained.

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ABSTRACT

The objective of this research was to verify whether teacher expectations of students' achievement in mathematics in solving elementary arithmetic problems are related to students' performance in these problems. The sample was 1,420 students and 66 teachers from 48 schools in Spain.

First, we assessed whether differences existed in the level of resolution among students, with regard to such factors as grade, gender, or socioeconomic status. We then evaluated teachers' level of expectations of students in relation to the same factors. Finally, we aimed to verify to what extent teachers' expectations corresponded to students' performance levels.

It was found that there is a moderate correlation between expectations and achievement, and that expectations were greater than the results. A comparison is made with the results of previous studies.

1. Introduction

1.1. Teacher expectations and student achievement

For several decades now, the importance of personal factors, in both teachers and students, has been widely acknowledged in research in education, and in mathematics education in particular. One of the most researched aspects in teachers' beliefs relates to the expectations that they have of their students.

Teacher expectation refers to the expected level of success for a specific child, based on assumptions about different issues such as the student's capacity or motivation, amongst others. Taking these into account, the teacher predicts the future achievement of this student.

This is usually known as the "Pygmalion Effect" or "self-fulfilling prophecy" (Rosenthal and Jacobson, 1968). Briefly, it means that although teacher expectations could be wrong at the beginning, they influence student behavior in such a way that his/her achievements will eventually adapt and conform to initial expectations.

Similar research has been carried out in different educational levels, subjects and conditions (Rosenthal, 1974; Glesner, 2002; Jussim and Harber, 2005; Rubie-Davies, 2006; Tutwiler, 2007; Hinnant, O'Brien and Ghazarian, 2009; Peeters et al., 2009); Jussim et al. (2009); McKown et al. (2010).

In the field of mathematics education, the classic works of McLeod and Adams (1989), McLeod (1992) or Thompson (1992) have identified factors such as feelings or beliefs about the nature of mathematics which directly influence its teaching and learning.

All of these studies highlight how teachers' beliefs relate to their teaching practices, strategies for motivating students or their expectations of success (Stipek et al., 2001; Chen, 2002; Fast et al., 2010). Several interesting reviews on this topic can be found in Phillips (2007) or Beswick (2012).

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1.2. How do teacher expectations develop?

Teachers usually develop expectations towards their students from previous information, which includes the following:

1. Social status. This is one of the most important characteristics which influence teachers when developing expectations, so that lower achievement is expected from lower social class backgrounds, indirectly related to the type of school that students attend (Madon et al., 1998; Pigott, and Cowen, 2000; Orr, 2003; Clewell and Campell, 2007; Schoenfeld, 2002; Tutwiler, 2007).

The professional culture of teachers in each type of school influences teacher expectations; this also occurs in mathematics (Moller et al., 2013), and the students themselves perceive these expectations, which are higher in private schools than in public schools (Mato and De la Torre, 2010).

2. Gender. Teachers expect better results from boys than from girls in certain subjects, and the opposite in others. Much research in the field of mathematics has shown how gender stereotypes promote greater participation of male students in careers related to science, and in particular mathematics (Fennema and Sherman, 2003; Eccles, 2007), due in large part to the different expectations of parents and teachers (Spencer et al., 1999; Tiedemann, 2000, 2002; Jacobs et al., 2005; Gallagher and Kaufman, 2005; Gunderson et al. 2012; Chamberlin, 2013).
3. Students' personal factors and, among these, their physical appearance or behaviour. This aspect has to do with the fact that teacher expectations are better towards younger students (Rubie-Davies, 2006; Hinnant, O'Brien and Ghazarian, 2009), while expectations against certain groups of more disruptive students are worse, as often happens at certain ages and in those students changing from primary to secondary school (McGee et al., 2004; Fernández and Figueiras, 2011; Bohlmann and Weinstein, 2013).

1.3. How and to what extent does the expectation effect work?

Like all human beings, teachers make assumptions and develop expectations, which may or may not be fulfilled.

First of all, teachers' perceptions can change: the more capable a student is seen by a teacher to be, the greater the learning opportunities he/she will receive. Conversely, if a teacher thinks that a student is less capable, he/she is likely to be given fewer opportunities to improve (Jussim and Harber, 2005; Jussim et al., 2009).

A second effect is that when teacher expectations are stated verbally, they condition students' self-expectations and motivate them to make greater or smaller efforts (Jussim and Harber, 2005; Jussim et al., 2009).

In summary, research in this field arrives at the following conclusions (Glesner, 2002; Weinstein, 2002; Jussim and Harber, 2005; Jussim et al., 2009; McKown et al., 2010; Beswick, 2012):

- Self-fulfilling prophecies do happen, but they tend to have moderate effects.
- The influence is greater on students in new environments (first year students, for instance).
- There is a higher tendency for expectations to become reality in low achievement students from low social classes or marginal backgrounds.
- The correlation between teacher expectations and student achievement is not regular in every subject; it seems to be lower in mathematics than in language.

1.4. Research objectives and research questions

The main objective of this research is to verify whether the results of prior research on teacher expectations related to students' achievement in mathematics, concerning elementary arithmetic problem-solving, can be generalized to schools in Extremadura, with regard mainly to gender, school year or social class stereotypes. To this end, the following research questions were considered:

- Question 1: Are there any differences between teacher expectations in different school years?
- Question 2: Are there any differences between teacher expectations of girls and boys?
- Question 3: Are there any differences between teacher expectations of students attending public and private schools?
- Question 4: Is there any relation between the marks given by teachers, according to their expectations, and students' achievement in problem-solving?

2. Method

2.1. Participants

The sample consisted of 1,420 students and 66 teachers from 48 schools in 28 different geographic locations in Extremadura, Spain. The students were attending 5th and 6th years of Primary Education and 1st year of ESO (Educación Secundaria Obligatoria - Compulsory Secondary Education), and were 11, 12 and 13 years old on average, as shown below (see Table 1):

The choice of these age groups is mainly due to two reasons: firstly, students from the 5th grade are young children and so, as mentioned in the literature review, the level and effect of expectations of teachers are higher. Secondly, among the groups of 6th grade primary and 1st year ESO, an important educational change occurs, from the primary stage to the secondary, which in Spain also coincides with a change of teachers with different didactical training and professional culture.

With regard to gender, the sample was distributed as follows (see Table 2):

Schools were selected according to four different categories: public (urban-centre, urban-periphery, rural) and private or publicly-funded private schools, as shown below (see Table 3):

Students attending these different types of centres correspond generally to families of different social and economic status. While the ones attending private or publicly-funded private centres have higher economic levels, those attending public schools have a lower level. Of these, students from lower income levels attend rural centres and, in the region in which the research was performed, public urban-centres.

2.2. Ethical considerations

Written informed consent was obtained from participants. We explained to the students that a decision not to participate would not affect them in any way. Confidentiality of the data obtained was guaranteed. The study involved educational interventions and corresponded to research with minimal risk. The results of the tests from this study were not used as participants' grades. Study records were anonymized. Additionally, the participants of each phase were informed and familiarized with the objectives of the study. The study proposal was reviewed and approved by the Bioethics and Biosafety Commission of the University of Extremadura.

Table 1. Sample/School year.

School year	Number of participants	Percentage
5 th Primary	311	21.9
6 th Primary	674	47.5
1st ESO	435	30.6
Total	1420	100.0

Table 2. Sample/Gender.

Gender	Number of participants	Percentage
Male	700	49.3
Female	720	50.7
Total	1,420	100.0

Table 3. Sample/School type.

School type	Number of participants	Percentage
Public urban-centre	516	36.3
Public urban-periphery	144	10.1
Public rural	320	22.5
Private or publicly-funded private	440	31.0
Total	1,420	100.0

2.3. Materials and procedure

Data collection was carried out by students of Psychopedagogy at the University of Extremadura during their period of practice in different schools, in the middle of the year.

Teachers in each class were asked to evaluate a priori whether each student would give the correct answer to 6 arithmetic problems (see Appendix).

In this way information on teachers' expectations was achieved more easily than in most of the studies included in the reviewed literature. In those studies the method usually consisted of questions to teachers, of the type: "Do you think (student's name) is more skilled? Do you think (he/she) is more willing? What do you think is their skill level in mathematics?" (See for example, Rubie-Davies, 2006 or Bohlman and Weinstein, 2013), which include complex issues that are difficult to evaluate. Our method excludes the effect of other academic and non-academic factors, such as teacher educational style, interest and motivation of the student, or their interactions. In sum, our study focuses on evaluating teachers' expectations but not on obtaining information relating to the above-mentioned factors. Therefore, a simple question was posed, which can be answered with yes/no.

Students were then asked to solve the problems. Finally, the problems were marked to determine whether the answers were right or wrong.

The problems to be solved by the students were, intentionally, the same for all participants, that is, elementary, adapted to the level of the students, and similar to those usually given in the classroom. Our intention was to give them typical mathematical tasks that could be evaluated quickly, without taking into consideration aspects such as the learning style of the students or their way of resolving the tasks proposed.

3. Results

3.1. Teacher expectations

Taking into account that the scoring for teacher expectation was rated from 0 (the student will not solve the problem) to 1 (the student will solve the problem), the average mark for each one would be the percentage of students that the teachers considered would give the right answer.

As can be seen, problem 2 was the easiest for the teachers, as they expected 82% of the students to give the right answer. Conversely, problem 4 was the most difficult one, as teachers only expected 41% of the students to solve it correctly.

Breakdown of data by school year (see Table 4):

As shown, teacher expectations are almost always better for 6th year Primary Education students (12 years old on average) whose teachers are primary school teachers, than for 1st year ESO students (13 years old on average), studying in secondary centres and whose teachers have a Bachelor's degree in mathematics. Students in 5th year of Primary Education (11 years old on average) are those with the worst expectations.

Since the teacher expectation variable is measured at the ordinal level, we used non-parametric tests: the Mann-Whitney test, the Wilcoxon test and the Kruskall Wallis test (Kruskall and Wallis, 1952). The Mann-Whitney test (Mann and Whitney, 1947) is a non-parametric test used when data measured only at the ordinal level are available, to test whether there are statistically significant differences between the data from two independent groups. Similarly, the Wilcoxon test (Wilcoxon, 1945) is used for related groups. When there are more than two independent samples of equal or different sample sizes, the Kruskal – Wallis test, also called one-way ANOVA on ranks, is used.

In non-parametric tests, a rating is used to recode the data into their sort order from lowest to highest. To calculate the average ranges, the data for each set is first recoded into its range, ordered from lowest to highest. Then the average ranges for each set are calculated. Higher average ranges will correspond to higher values and, the same for the lowest. The Kruskall-Wallis test was used to check statistically significant differences between teacher expectations in different school years (Table 5).

As the results show, there is a statistically significant difference ($p = .000$), seemingly in favor of pupils in the 6th year of Primary Education (there is a higher average rank) over the other groups.

From the analysis of each group, and their pairwise comparisons, the results were obtained as shown in Table 1 in the Appendix. It can be seen that there are significant differences ($p = .000$) between all groups. As mentioned previously, and taking into account average ranks, it can be concluded that the highest teacher expectations are of 6th year Primary Education children (higher than 1st year ESO).

Separating data by gender, expectations of boys (700) and girls (720) are the following (see Table 6):

It would seem that, in most cases, teacher expectations are higher for boys than for girls. To verify whether these differences are statistically significant, and because the variables in this study are measured at the ordinal level, the non-parametric Mann-Whitney test was used (see Table 7).

This test indicates that, although expectations seem to be higher for boys than for girls, there is no statistically significant difference ($p = .156$) and therefore teacher expectations for both girls and boys are not different.

Breaking down these data according to type of school, public (980 students) or private (440 students), the following results are obtained (Table 8):

Higher expectations can be seen, in all cases, in private school teachers. The Kruskall-Wallis test was used once again to verify whether these differences were statistically significant. The results are as follows (Table 9):

As the results show, there is a statistically significant difference ($p = .000$) in favour of teachers in private schools compared to teachers in public schools (higher average rank in private schools). This means that the former have higher teacher expectations towards their students.

Table 4. Teacher expectations/Problem/School year.

Teacher expectation	Total	1st ESO	6th Primary	5th Primary
Teacher expectation P1	.79	.77	.84	.72
Teacher expectation P2	.82	.83	.82	.82
Teacher expectation P3	.70	.66	.73	.69
Teacher expectation P4	.41	.44	.47	.25
Teacher expectation P5	.74	.69	.79	.69
Teacher expectation P6	.58	.56	.66	.45

Note. "Teacher expectation P1" represents the average value (mean) of teacher expectation of the answers to problem 1, "Teacher expectation P2" represents the average value of teacher expectation of the answers to problem 2, and so on.

Table 5. Teacher expectations/School year. Kruskall-Wallis test.

School year	N	Average rank
5 th Primary	311	590.64
6 th Primary	674	774.58
1 st ESO	435	696.91
Total	1,420	

Note. Chi-square: 45.759. Df: 2. Asymp. Sig.: .000.

Table 6. Teacher expectations/Gender.

Teacher expectation	Total	Boys	Girls
Teacher expectation P1	.79	.79	.80
Teacher expectation P2	.82	.82	.82
Teacher expectation P3	.70	.70	.69
Teacher expectation P4	.41	.45	.38
Teacher expectation P5	.74	.75	.73
Teacher expectation P6	.58	.59	.58

Note. "Teacher expectation P1" represents the average value of teacher expectation of the answers to problem 1, "Teacher expectation 2" represents the average value of teacher expectation of the answers to problem 2, and so on.

Table 7. Teacher expectations/Gender. Mann-Whitney U test.

Gender	n	Average rank	Sum of ranks
Male	700	725.77	508036.50
Female	720	695.66	500873.50
Total	1420		

Note. Mann-Whitney U test: 241313.500; Wilcoxon W test: 500873.500; Z: -1.419; Asymp. Sig. (2-tailed): .156.

Table 8. Teacher expectations/School Type.

Teacher expectation	Total	Public	Private
Teacher expectation P1	.79	.76	.87
Teacher expectation P2	.82	.80	.88
Teacher expectation P3	.70	.65	.81
Teacher expectation P4	.41	.40	.44
Teacher expectation P5	.74	.69	.84
Teacher expectation P6	.58	.53	.70

Note. "Teacher expectation P1" represents the average value (Mean) of teacher expectation of the answers to problem 1, "Teacher expectation 2" represents the average value of teacher expectation of the answers to problem 2, and so on.

Table 9. Teacher expectations/School Type. Kruskall-Wallis test.

School type	n	Average rank
Public urban-centre	516	675.97
Public urban-periphery	144	642.40
Public rural	320	675.43
Private or publicly-funded private	440	798.79
Total	1,420	

Note. Chi-square: 31.937. Df: 3. Asymp. Sig. (2-tailed): .000.

If we compare data in pairs, by type of school, we obtain the following results (Table 2 in the appendix). Once more we can see that there are no statistically significant differences between public schools, whereas differences between public and private schools are statistically significant in favor of the latter. This indicates that teacher expectations are higher in private than in public schools (in all cases).

3.2. Students' results

Taking into account that the scoring in problem-solving varies from 1 (right) to 0 (wrong), the average scoring for each problem will be the percentage of students who solved the problem correctly. As can be observed, problems number 4 and 6 were the most difficult, correctly solved by 36% of the students. The easiest was number 2, correctly solved by 75% of the students.

Separating the data by school year, the following (see Table 10) results are obtained:

The results are almost always better for students in the 1st year of ESO, as expected, although there is a small difference. The non-parametric Kruskall-Wallis test (see Table 11) was used to verify whether differences between the students' achievement in each school year are statistically significant.

The results show statistically significant differences between groups. The extent of these differences can be checked by comparing them in pairs (see Table 3 in the appendix):

The results of these comparisons show that there are no statistically significant differences between students in 1st year of ESO and 6th year of Primary Education, whereas differences between 5th year Primary Education students and the other groups are statistically significant. The results of the 5th year students are worse.

Breaking down data by gender (Table 12), the following is obtained:

As can be seen, the boys performed better than the girls in almost every case. The Mann-Whitney test (see Table 13) was used to verify whether these differences are statistically significant (The test shows statistically significant differences in favour of the boys ($p = .039$)):

Finally, data were separated according to school type (see Table 14):

At first sight, students from private schools performed better than those attending public schools (in almost every case). To verify whether there are differences among school types, the non-parametric Kruskall-Wallis test (see Table 15) was applied.

Differences are statistically significant ($p = .000$), school types were compared in pairs to determine the differences (see Table 4 in the appendix). According to data and average ranks, it can be stated that:

- With regard to students' achievement, the differences between public rural or urban-centre schools, and private schools, are significant in favour of private schools.
- The differences between rural public schools and urban-periphery schools are significant in favour of urban-periphery schools.
- There are statistically significant differences between urban-centre and urban-periphery public schools in favour of the latter.
- There are no significant differences between urban-centre public schools and rural public schools.
- The differences between private and urban-periphery public schools are not statistically significant.

Table 10. Students' performance/Problem/School year.

Students' performance	Total	1st ESO	6th Primary Ed.	5th Primary Ed.
Students' performance P1	.59	.60	.64	.46
Students' performance P2	.75	.80	.78	.61
Students' performance P3	.65	.70	.67	.51
Students' performance P4	.36	.40	.38	.27
Students' performance P5	.43	.49	.47	.27
Students' performance P6	.36	.34	.40	.30

Note. "Students' performance P1" represents the average value of the students' performance on the answers to problem 1, "Students' performance 2" represents the average value of students' performance on the answers to problem 2, and so on.

Table 11. Students' performance/School year. Kruskall-Wallis test.

School year	n	Average rank
5 th Primary Ed.	311	552.24
6 th Primary Ed.	674	759.07
1st ESO	435	748.39
Total	1420	

Note. Chi-square: 61.057. Df: 2 Asymp. Sig.: .000.

Table 12. Students' performance/Gender.

Students' performance	Total	Boys	Girls
Students' performance P1	.59	.59	.59
Students' performance P2	.75	.76	.74
Students' performance P3	.65	.65	.64
Students' performance P4	.36	.38	.34
Students' performance P5	.43	.46	.40
Students' performance P6	.36	.40	.33

Note. "Students' performance P1" represents the average value of the students' performance on the answers to problem 1, "Students' performance 2" represents the average value of students' performance on the answers to problem 2, and so on.

Table 13. Students' performance/Gender. Mann-Whitney U test.

Gender	n	Average rank	Sum of ranks
Male	700	732.98	513084.00
Female	720	688.65	495826.00
Total	1,420		

Note. Mann-Whitney U test: 236266.000; W de Wilcoxon W test: 495826.000; Z: -2.063; Asymp. Sig. (2-tailed): .039.

Table 14. Students' performance/Problem/School type.

Students' performance	Total	Public	Private
Students' performance P1	.59	.55	.67
Students' performance P2	.75	.70	.85
Students' performance P3	.65	.60	.74
Students' performance P4	.36	.37	.34
Students' performance P5	.43	.40	.50
Students' performance P6	.36	.34	.40

Note. "Students' performance P1" represents the average value of the students' performance on the answers to problem 1, "Students' performance 2" represents the average value of students' performance on the answers to problem 2, and so on.

Table 15. Students' performance/School type. Kruskall-Wallis test.

School type	n	Average rank
Public urban-centre	270	323.99
Public urban-periphery	77	387.42
Public rural	162	353.67
Private or publicly-funded private	211	402.65
Total	720	

Note. Chi-square: 18.921. Df: 3 Asymp. Asymp. Sig.: .000.

3.3. Relation between teachers' expectations and students' achievement

The relation between teachers' expectations and students' achievement can be examined by calculating correlations among values. For this, the Spearman Correlation Coefficient was used. The correlation was 0.569, which can be considered as an intermediate correlation value and is statistically significant ($p = .000$).

Finally, the Wilcoxon test was applied to verify whether teacher expectations were higher or lower than students' performance (see Table 16).

Table 16. Teacher expectations/Student's performance. Wilcoxon test.

Ranks	n	Mean rank
Negative ranks	243 (a)	446.60
Positive ranks	829 (b)	562.85
Ties	348 (c)	
Total	1420	

Note. a.Teacher < Student; b.Teacher > Student; c.Teacher = Student. Z: -17.919 (based on negative ranks). Asymp. Sig. (2-tailed): .000.

From these data it can be concluded that there are statistically significant differences between teacher expectations and real student performance. Teacher expectations are higher than real student performance in the majority of cases (829 out of 1420).

3.4. Analysis of results

Summarizing results and answering the previous research questions, we can state that:

1. There is a correlation between teacher expectations and students' results in solving elementary arithmetic problems (question 4). It is an intermediate correlation value (0.569), a finding similar to that of other studies carried out in other areas, such as those of Glesner (2002) or Rubie-Davies (2006).
2. In the present study it can also be seen that, in all cases, teacher expectations are always greater than students' results (question 4). These results agree with those of Rubie-Davies (2006), Bohlmann, and Weinstein (2013) or Chamberlin (2013), among others.
3. The results also confirm differences regarding students' performance in public and private schools in favour of private schools. But there are no differences in children of similar socio-economic backgrounds, nor is there when comparing publicly-funded private schools and urban-periphery public schools. However, as the other previously mentioned studies (i.e. Schoenfeld (2002), Clewell and Campell (2007), Tutwiler (2007) or Mato and De la Torre (2010)) have pointed out, teacher expectations are always higher in private than in public schools (question 4).
4. The results show that in solving elementary arithmetic problems, there is no difference between the performance of 1st year ESO and 6th year Primary Education students, although there are differences when compared to 5th year Primary students. However, expectations towards students in 1st year of ESO, who have recently enrolled at Secondary schools, are lower than expectations towards students from the previous year (6th year of Primary Education) who are still at Primary school, despite the fact that the difficulty of the arithmetic problems to be solved is the same (question 1). Some studies, for example McGee et al. (2004), although carried out in a different school context, point in the same direction.
5. There is no difference in teacher expectations of girls or boys (question 2) despite the fact that boys' results are considerably better when solving elementary arithmetic problems. These results are different from those found in previous studies, such as the classic works of Fennema et al. (1990) or Madom et al. (2001).

4. Conclusion

The results from the present work are in line with those from other studies which have been reviewed in the prior analysis of results. For this

reason, further research is required to more fully explore those aspects which recur over time.

With regard to the teaching of mathematics, some results are positive and some are negative.

On the positive side, we can state that the stereotype associated with gender and mathematics is disappearing, or at least, is diminishing among teachers in practice in the classroom, at the levels studied.

However, one negative result is that expectations are subject to prevailing stereotypes still associated with the social class of students.

Finally, we highlight the fact that lower expectations are maintained by teachers towards students of 1st year of secondary school, even though the results do not confirm these expectations. Is this due to the persistence of prejudice against certain usually more disruptive groups in the classroom or is it the result of different professional cultures and different pedagogical training of teachers in primary and secondary school?

Further research would help to shed light on the above aspects, and to answer other questions which have arisen: What does it mean that teacher expectations are higher than student responses? Why are the expectations of private school teachers greater than those of teachers in public schools? Why do teachers of 1st year ESO have lower expectations than teachers of 6th year Primary Education, for the same tasks?

Although teachers have changed to some extent over the years and, as has been pointed out previously, some stereotypes seem to have been broken down, such as the one concerning the gender of our students, others are maintained. How can these stereotypes be modified during initial teacher training?

Declarations

Author contribution statement

Luis Manuel Soto-Ardila: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Ana Caballero-Carrasco; Luis Manuel Casas-García: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data.

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Data availability statement

The authors do not have permission to share data.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix

Appendix a: problems posed

Problem 1. If a cyclist covers 36 km in 2 h, how many km. will he cover in 9 h?

Problem 2. A merchant received 4 boxes of eggs, one with 420 eggs, one with 180 and a third with 256 eggs. How many eggs will the fourth box contain if he should receive one thousand eggs?

Problem 3. A businessman went into a store with 1000 euros to buy trousers and came out with 150 euros. If he bought 50 pairs of trousers of the same price, how much did each pair of trousers cost?

Problem 4. The surface of a rectangular field is 4320 square meters. If we know that one side is 60 feet, how long is the other side?

Problem 5. A winemaker sold 150 L of white wine at 4.60 euros per litre and 130 L of red wine at 5.70 euros per litre. How much did he get for selling all the wine?

Problem 6. A truck carries 2650 bricks and downloads a fifth of them. How many bricks remain in the truck?

Appendix b: results tables

Table A1. Teacher expectation / School year. Pairwise comparison

School year	n	Average rank	Statistics and significance	
1st ESO	435	395.57	Mann-Whitney U test	58043.000
5th Primary Education	311	342.63	Wilcoxon W test	106559.000
Total	746		Z	-3.365
			Asymp. Sig. (2-tailed)	.001
1st ESO	435	519.34	Mann-Whitney U test	131082.500
6th Primary Education	674	578.02	Wilcoxon W test	225912.500
Total	1109		Z	-3.083
			Asymp. Sig. (2-tailed)	.002
5 th Primary Education	311	404.00	Mann-Whitney U test	77128.500
6 th Primary Education	674	534.07	Wilcoxon W test	125644.500
Total	985		Z	-6.842
			Asymp. Sig. (2-tailed)	.000

Table 2. Teacher expectation / School Type. Pairwise comparison

School Type	n	Average rank	Statistics and significance	
Public urban-centre	516		Mann-Whitney U test	35211.000
Public urban-periphery	144	334.26	Wilcoxon W test	45651.000
Total	660	317.02	Z	-.980
			Asymp. Sig. (2-tailed)	.327
Public urban-centre	516		Mann-Whitney U test	82513.000
Public rural	320	418.41	Wilcoxon W test	215899.000
Total	836	418.65	Z	-.014
			Asymp. Sig. (2-tailed)	.989
Public urban-centre	516		Mann-Whitney U test	93808.000
Private or publicly-funded private	440	440.30	Wilcoxon W test	227194.000
Total	956	523.30	Z	-4.768
			Asymp. Sig. (2-tailed)	.000
Public urban-periphery	144		Mann-Whitney U test	21929.000
Public rural	320	224.78	Wilcoxon W test	32369.000
Total	464	235.97	Z	-.848
			Asymp. Sig. (2-tailed)	.396
Public urban-periphery	44		Mann-Whitney U test	24926.000
Private or publicly-funded private	440	245.60	Wilcoxon W test	35366.000
Total	584	307.85	Z	-3.971
			Asymp. Sig. (2-tailed)	.000
Public rural	320		Mann-Whitney U test	58019.000
Private or publicly-funded private	440	341.81	Wilcoxon W test	109379.000
Total	760	408.64	Z	-4.267
			Asymp. Sig. (2-tailed)	.000

Table 3. Students' results / School year. Pairwise comparison

School year	n	Average rank	Statistics and significance	
1st ESO	435	418.42	Mann-Whitney U test	48103.500
5th Primary Ed.	311	310.67	Wilcoxon W test	96619.500
Total	746		Z	-6.827
			Asymp. Sig. (2-tailed)	.000
1st ESO	435	547.97	Mann-Whitney U test	143538.000
6th Primary Ed.	674	559.54	Wilcoxon W test	238368.000
Total	1109		Z	-.595
			Asymp. Sig. (2-tailed)	.552
5th Primary Ed.	311	397.57	Mann-Whitney U test	75128.500
6th Primary Ed.	674	537.03	Wilcoxon W test	123644.500
Total	985		Z	-7.236
			Asymp. Sig. (2-tailed)	.000

Table 4. Students' performance / School type. Pairwise comparison

School Type	n	Average rank	Statistics and significance	
Public urban-centre	516	322.68	Mann-Whitney U test	33116.000
Public urban-periphery	144	358.53	Wilcoxon W test	166502.000
Total	660		Z	-2.020
			Asymp. Sig. (2-tailed)	.043
Public urban-centre	516	420.53	Mann-Whitney U test	81515.000
Public rural	320	415.23	Wilcoxon W test	132875.000
Total	836		Z	-.312
			Asymp. Sig. (2-tailed)	.755
Public urban-centre	516	434.42	Mann-Whitney U test	90776.000
Private or publicly-funded private	440	530.19	Wilcoxon W test	224162.000
Total	956		Z	-5.429
			Asymp. Sig. (2-tailed)	.000
Public urban-periphery	144	251.41	Mann-Whitney U test	20317.000
Public rural	320	223.99	Wilcoxon W test	71677.000
Total	464		Z	-2.060
			Asymp. Sig. (2-tailed)	.039
Public urban-periphery	144	281.89	Mann-Whitney U test	30151.500
Private or publicly-funded private	440	295.97	Wilcoxon W test	40591.500
Total	584		Z	-.884
			Asymp. Sig. (2-tailed)	.377
Public rural	320	338.71	Mann-Whitney U test	57027.500
Private or publicly-funded private	440	410.89	Wilcoxon W test	108387.500
Total	760		Z	-4.542
			Asymp. Sig. (2-tailed)	.000

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