

# The Impact of Internet Economics, Computer, and Family Educational and Financial Background on Students' Academic Performances: Evidence from Mexican Seven Graders

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## ABSTRACT

The new millennium has seen the world transforming from a handicraft and manufacture-based economy to one that relies heavily on technology and innovation. Accompanying such trends are teachers nowadays trying to utilize technological devices to facilitate or enhance their teaching experience for students. This essay evaluates the effects of computers and the Internet along with family background such factors as a family's financial background, educational background, and the students' family size and gender on Mexican seventh graders' study performances using the OLS model in R language to analyze. The results of the data evaluation reveal that the students' access to computers or the Internet overall have no significant effect on Spanish and Math grades since students use the Internet distinctively and the influence is more significant in the long run. Also, mothers' education level only bonuses students' Spanish scores, while fathers' education has smaller effects on both scores. The findings that echoed previous studies on how some educationists predict the effect of the Internet will be along with how the role of gender played in traditional Mexican households affects their children's grades.

**Keywords:** Internet; computer; grades; gender; Mexico; family wealth

## 1. INTRODUCTION

With the development of technology and specific advanced devices, the use of computers and the Internet started to play a crucial and irreplaceable role in daily life. Such strong technological tools are having an important impact on many aspects of education, economics, and politics. In education, study methods have significantly transformed when compared to conventional study methods, especially in terms of learning tools and educational supplements such as iPad, educational software, and projectors. Through these innovative tools, students can gain a more complete understanding of the course and improve their academic performance. However, along with the positive effects brought about by the widespread use of educational technology, there are still some demerits and potential downsides such as internet addiction and cyberbullying that could have a negative impact on both the physical

and mental health of students. This paper seeks to specifically explore the effects of the internet and computers on math and Spanish grades.

This paper is structured in the following pattern:

1. The significance of the influence on math and Spanish courses that results from the use of computers and internet access
2. The possible attributes of these data results.
3. Concluding statements on the "Internet, Computer and Influence" topic
4. Suggestions for further research

## 2. BACKGROUND

In 2019, 60% of Mexicans were Internet users. This number is forecasted to increase to 70% by 2025 (Statista, 2021). Mexico is an underdeveloped country

with high economic inequality. Internet or computer usage in Mexico correlates with students' family income, place of residence, and other factors that also affect academic performance.

Educational Economics is a branch of economics that contains research on efficiencies in education and its relationship with economics. Like most other fields of economics, different research methods, quantitative or qualitative, are commonly used in Educational Economics. Many pieces of research in this field contain analysis of massive data relating to different variables that describe people, societies, and education. This research is going to analyze data using the OLS Model in R Language in Educational Economics.

### 3. LITERATURE REVIEW

Bando et al's 2016 study points out there are both beneficial and harmful impacts related to using the computer to study instead of more traditional forms such as books. Specifically, the results from their program in Honduras that replaced local elementary students' use of traditional textbooks with computers. Surprisingly, the study did not find a significant difference in students' learning performance as a result of the exchange. However, the silver lining of the study was the fact that replacing textbooks with laptops is actually more cost-effective, meaning the previous textbooks cost more than a multifunctional computer [1]. In 2008, Wainer et al explained in detail the negative effects brought by using the internet to study. By conducting a test based on the frequency of computer and internet use and access to these tools, Wainer et al. found that students would experience a drop in their grades as the time of computer and internet use increase; conversely, students who have no access to internet and computer have a higher average score on tests and assignments than students who have the access and regularly use internet and computer in their learning process [2]. Different results were reached by Shahibi and Rusli who discovered positive reinforcement brought by studying using computers and the internet. In fact, Shahibi and Rusli concluded that 5 disparate factors, which are Facebook usage, internet usage, online media usage for education, online usage for non-education, and student interest in the university, are typical influencing factors on academic performance. As long as students do not waste too much of their time on useless materials that have nothing to do with education, Shahibi and Rusli suggest, internet and computer use are positive factors on students' academic performance [3]. Bulman and Fairlie took a deeper look at the study efficiency improvement that Bando studied by analyzing the difference in the theoretical and empirical literature on educational technology. Bulman and Fairlie found that information and communications technology (ICT) investment and computer-aided instruction (CAI) use in school and home school education had a positive impact.

In the context of school technology usage in education, because most laptops and other technological devices are based on supplemental funding, yielding positive effects. Although studies of CAI and ICT in school use reveal mixed evidence with the pattern of null results. It is also worth noting that the CAI interventions are mainly used in math programs compared to other languages studies. The situation is rather different when facing technological use in education at home. Bulman and Fairlie point out that early studies in developing countries revealed positive impacts while recent ones show less beneficial effects, instead of yielding small or null effects [4]. Noreen Akhter found no improvement after replacing traditional books with technological devices such as computers. She ascribes the lack of improvement to computer addiction. Specifically, Akhter believes that the addiction has something to do with poor academic performance, including a decline in study habits, a significant drop in grades, missing classes, increased risk of being placed on academic probation, and poor integration in extracurricular activities. The situation is even worse for adolescents. Since adolescent internet addicts often suffer from severe psychological distress, such as depression, anxiety, compulsivity, and feeling of self-effacement, Akhter concludes that young Internet users are more at risk of becoming internet addicts than older users [5]. Complementing Akhter's study on how the Internet affects young people, Sestak et al. specifically expand the situation towards young children who suffer from poverty. Sestak et al. (2020) state that the poverty and age of children have an inverse relationship with regard to the influence of internet and computer use on their academic standing. As the level of impoverishment goes up, their grades decline given the access to and use of the internet and computer [6].

### 4. METHODOLOGY

All the models are to determine the effect of several variables on students' Spanish and math grades that not only include the internet and computer effect, but also some other important factors that, based on the model analysis, are shown to have a significant influence.

### 5. MODEL

The models built are ordinary least squares regressions with Spanish grades and math grades as dependent variables, and class attendance, these students' age, their gender, the education level of these students' parents, the total number of children in their homes, internet and computer, and the frequency of attending classes as the independent variables:

1. *Spanish/Math grades = a\*internet and computer + ε*
2. *Spanish/Math grades = a\*internet and computer + b\*frequency of attending classes + c\*child total +*

$$d \cdot \text{class attention} + e \cdot \text{mothers' education level} + f \cdot \text{fathers' education level} + g \cdot \text{sex} + h \cdot \text{age} + \varepsilon$$

Since the internet and computer variables are combined into a new, individual variable, the original data like were modified as the following: if a student has access to the internet as well as a computer, then the value of that variable is defined as 1; if a student has either access to the internet or a computer, then the value is 0.5; if a student has neither of these, the value is 0. Having a computer but no internet can still influence students' grades in some ways, some typical cases are: using computers to program, analyze data, do some computational problems or practicing languages by writing, and listening with software that does not need an internet connection. Having access to the internet but not having a computer, on the other hand, is also helpful: students' can use their phone or other electrical devices to search for learning materials on the internet. Therefore, the value was set equal to 0.5. In the model, an assumption is that students will receive more benefits if they have both access to the internet and a computer than having only one of these tools. It's rational to believe this assumption holds because students' who have both the internet and computer can have access to a large number of learning materials easily and are able to gain much more useful stuff compared to the ones who don't.

For variables including class attention and the frequency of attending classes, the raw data of these categorical variables contain five disparate categories with each representing a unique level. The values are set according to the categories, which are never, almost never, sometimes, almost always, and always, as the following: never=0, almost never=0.2, sometimes=0.5, almost always=0.8, always=1. And for age, the value was set equal to 1 if the student is a male, otherwise 0.

Due to the incompleteness of the data set, the lagged terms are not included.

In the first stage, only the sole effect of the internet and computer is considered in order to gain some information about what kind of influence the internet and computer will have on students' grades. Afterward, all

the other variables were added one by one so that the impact of each individual variable on the whole model can be found.

To interpret the models further, more regression models were built between some independent variables to check if there's inter-correlation between them, which might influence the results in some ways:

1. Internet access ~ family income
2. computer access ~ family income
3. family income ~ mothers' education level
4. family income ~ fathers' education level
5. Spanish grades ~ family income
6. Math grades ~ family income

Because only a very small portion of students answered the question about their family income, it would be inconclusive to use family income as an independent variable in the model. Therefore, the models are built up by several simple linear regressions between family income and some other variables in this model to gain more information about how the family background will affect students' grades.

Based on the model, one can determine the effect of every single variable that is included in these models, and also find out some inter correlation between the independent variables. However, the lagged terms were not taken into consideration, thus the model might not fully explain the changes to students' grades in successive years.

## 6. RESULTS AND INTERPRETATION

### 6.1. Results

The data that were used to build models and form analysis is from a survey that was directed to some Mexican students and 8587 of them were selected in the data set. These students were in seventh grade in 2008. However, due to some inevitable situations, some students didn't answer certain questions from the survey so that for some variables, not enough data are available.

**Table.1** The summary of the OLS models between independent variables and students' Spanish grades

independent variable	Estimated parameter	Standard error	P-value	significance level
internet and computer	14.364	10.445	0.169579	insignificant
mothers' education level	10.633	3.191	0.000914	***
fathers' education level	8.491	3.182	0.007829	**
sex	-41.727	8.482	1.12e-06	***
age	-3.771	6.185	0.542317	insignificant

class attention	105.300	19.998	1.94e-07	***
frequency of attending classes	53.260	14.192	0.000192	***
child total	2.174	2.656	0.413463	insignificant

Table 1 shows that the internet and computer, the education level of these students' parents, class attention, the frequency of attending classes, and the total number of children a family has all have a positive effect on Spanish grades while age has a negative effect; but the

effect of age, computer and the Internet, and the total number children in a family are not significant. Moreover, women tend to outcompete men in Spanish grades.

**Table.2** The summary of the OLS models between independent variables and students' Math grades

independent variable	Estimated parameter	Standard error	P-value	significance level
internet and computer	6.734	12.702	0.59619	insignificant
mothers' education level	6.268	3.881	0.10677	insignificant
fathers' education level	9.550	3.870	0.01388	*
sex	-9.279	10.316	0.36874	insignificant
age	-13.271	7.522	0.07818	insignificant
class attention	122.908	24.320	5.73e-07	***
frequency of attending classes	55.012	17.260	0.00151	**
child total	7.320	3.230	0.02381	*

Table 2 demonstrates that the internet and computer, the education level of mother and father, class attention, frequency of attending, and child total have a positive influence on math grades while age has a slightly negative effect. Additionally, women's grades are higher than men's but in a very insignificant way.

1. the access of internet ~ family income: positive relationship (significance level: \*\*\*)
2. computer access ~ family income: positive relationship (significance level: \*\*\*)
3. family income ~ mothers' education level: positive relationship (significance level: \*\*\*)
4. family income ~ fathers' education level: positive relationship (significance level: \*)
5. Spanish grades ~ family income: positive relationship (significance level: \*\*\*)
6. Math grades ~ family income: positive relationship (significance level: \*\*\*)

**6.2. Interpretation**

*6.2.1. Internet and computer ~ Spanish grades*

The significance level of Internet and Computer to

Spanish grades is zero stars. Because of the original character of language learning, it demands time to practice those pronunciations, grammar, and vocabulary to enable students to be familiar with them. As a result, only through teaching can teachers impart knowledge to students. The use of the Internet and computers has little benefits with the educational process of language learning. What's more, some online resources would give students professional support and enable them a more comprehensive understanding of the courses. However, apparently, the language learning is a long-term process. Consequently, such support would bring them a significant promotion through a long period, and that is the reason for the zero stars.

*6.2.2. Education level ~ Spanish grades*

The significance level of mothers' education to Spanish grades is three stars and fathers' education is two stars. Family support and help are a strong and significant part of learning. In the process of learning, children may have a lot of obstacles and questions about the specific courses that they have learned in the academy. As a result, the parent's educational background is of great importance to problem-solving.

As for the Spanish, the female tends to have a better performance on the language learning, and they tend to stay with their children for longer times. That is the reason why mothers' education is more important than fathers' education on the Spanish grades.

### 6.2.3. *Sex ~ Spanish grades*

The significance level of sex is three stars to Spanish grades. It is negatively related, which means that females are more advantageous than males. The reason is that females in Mexico are usually seen as suitable for Spanish based on gender stereotypes.

### 6.2.4. *Age ~ Spanish grades*

The significance level of Age to Spanish grades is a zero star. Age has a negative effect on Spanish. With the development of children and their mother language learning, they tend to show less efficiency in learning another language. That is the reason for the solidified language system that formed in their mind. This system is a kind of cognitive mode, which may exert influence on the growing children who learn another language. As a result, their childhood is the best time for them to learn a language.

### 6.2.5. *Class attention, the frequency of attending classes ~ Spanish and Math grades*

The significance level of Class attention and attend-class-in-school are both three stars to Spanish grades. There is no doubt that full concentration on the textbook and teaching is of great significance to the educational process and absorbing knowledge. That's what many people have learned since an early age. More class attention and attendance in school can guarantee students a basic understanding of the course and enable them the fundamental concept of what they have learned. In Spanish learning, fundamental concepts like vocabulary and grammar are essential factors of learning. They are just like the brick, with the accumulation of those bricks a building would be eventually constructed. The teaching process can be exactly described as accumulation. The logic of accumulation can also be applied in math learning. The basic knowledge of math is considerably significant and only through focused listening and diligent practicing can students gain a better performance. Based on that, the factor of class attention and attending class in school is important to Spanish and Math grades.

### 6.2.6. *Child total ~ Spanish grades*

The significance level of Child total to Spanish is a zero star. With the more children in a family, they can communicate with each other that they have more

chances compared to their peers to practice their oral speaking and discuss the problems that they encounter in the learning process. However, this factor has limited influence on the Spanish grades because students should learn to practice their professional skills by themselves, in order to form a more comprehensive understanding of the specific courses.

### 6.2.7. *Internet and Computer ~ Math grades*

The significance level of Internet and Computer to math grades is zero stars. Since there are many accessible online resources and technique supports which can be beneficial for students to find some related materials and books or to build a mathematical model to interpret data. Through those technique supports; students can take advantage of them and form a better understanding of the specific concepts. However, even today, many students are still used to learning math by the textbook, which is the most appropriate for education. There is no doubt that there are many Internet resources, but those materials are less effective for an individual.

### 6.2.8. *Education level of parents ~ Math grades*

The significance level of mothers' education to math grades is zero star and fathers' education is one star. As has been discussed, family support is an essential and significant part of the process of learning. However, as for the Math grades, the male tends to show higher and better performance than the female. Consequently, fathers' education has more influence than mothers' education.

### 6.2.9. *Sex ~ Math grades*

The significance level of sex is one star to math grades. It is negatively related, which means that males tend to have poorer performance than females. It can be considered as the result of the lack of caution that would make them fall into a question trap and misinterpret the data and eventually make them miss the right answer. On the other hand, this relationship isn't significant so it's reasonable to assume that there actually should be a rather small difference between females' and males' math grades.

### 6.2.10. *Age ~ Math grades*

The significance level of age is three stars to math grades. It is negatively related, which means that the older the age, the poorer performance on math grades. Because of the increasing difficulty, including the complicated formula and specific concept, of math, many students will feel exhausted and get stuck with the esoteric mathematical knowledge and therefore are likely to get relatively lower grades.

### 6.2.11. *Child total ~ Math grades*

The significance level of the total number of children is one star to math grades. Children in a family which has more children than a normal family are more likely to have a comparing mentality. When their brother or sister achieves better performance, they want to compete with them to win their parents' hearts. Driven by this kind of motivation, their academic performance will be promoted. However, if this thought is misled, it may lead to a bad result.

### 6.2.12. *Internet and computer ~ family income*

According to the research conducted by Pew Research, income can determine the frequency of surfing online. There is a positive correlation between high income and Internet penetration. Even considering the factors such as age, gender education, and race, income is still the decisive factor among them. The significance level of family income to the Internet is three stars which indicate that there is a strong positive relationship between them. This is the result of the decent financial condition. Apparently, in the era of high technology and swift development, the Internet and Computer can be concluded as the essential factor for every family whatever the financial conditions are. When it comes to the wealthy family, it is the decent financial condition and monetary support that benefit people to get access to the abundant Internet resources and the chance to use the computer would be gained. What's more, the higher the family income is, the more possible that parents' jobs are related to modern digital technology. For the reason that in modern society, the nature of work has been predominantly moved from manual labor to a service economy based on innovation. Consequently, people who have an inferior family income can have little chance to use the Internet and computers in their daily work.

### 6.2.13. *Education level of parents ~ family income*

The significance level of mothers' education to family income is three stars and the significance level of fathers' education is one star. Conventionally, women's education has always been a hotly debated topic. Countless women and girls cannot take formal education and their enrollment rate is always far lower than men. Based on that, if a mother can have a relatively well educational background, it means that she was born in a wealthy family, or her parents have an equal notion. With their educational background, they can get more chances to meet that high-quality man and marry them. As a result, the family income can be significantly promoted. Compared to women, men tend to have a wider range of choices to choose their wives. Besides, based on the traditional cultural background, the man can take charge

of the family financial fair, and what women usually do is those family fairs such as housekeeping and child-raising. Consequently, from the traditional notion, men do not need a very competent woman. So, this might be why fathers' education has a lower relationship to family income compared to mothers' education. Generally, nevertheless, parents with higher education levels will be paid more.

### 6.2.14. *Spanish and Math grades ~ family income*

It's not surprising to find that family income has a positive correlation with Spanish and Math grades. Family income, in most situations, will lead to better access to the internet and more likely to have a computer, thus students will have more of these tools when they're studying, which can boost their grades. Furthermore, as mentioned above, parents with high salaries often mean that they received a pretty good education. That being the case, whenever their children have some difficulties in studying, they are capable of teaching them correctly.

## 7. CONCLUSION

This study finds that students' access to computers or the Internet overall has no significant effects on their Spanish and Math grades, but other factors are much more influential. Relatively, the usage of computers and the Internet have a greater influence on Spanish scores than on Math scores. Internet or computer usage is not a very significant factor in students' scores because of two reasons. One, students with different study habits or lifestyles use computers or the Internet in different ways, and this leads to an overall insignificant result. Second, the Internet or computers' influence may be more significant in the long run. Students need time to learn how to utilize them effectively, and with time, they can receive more benefits from them.

Several other important findings were found based on the data. Firstly, mothers' education level only bonuses students' Spanish scores, while fathers' education has smaller effects on both scores. This can be explained by gender roles. Females tend to pay more attention and effort within families, so an educated mother tends to provide a better family education, which allows children to learn Spanish better in childhood. In contrast, Mathematics is less affected because it depends more on practice than on family education. Fathers' education has some effects on both Spanish and Math scores, which may be caused by its relationship with family income.

Secondly, based on the data, females have significant advantages in Spanish and little or no advantages in Math. According to Freeman (2004), females tend to have higher average scores in school. In Mexico, males tend to be more confident in Mathematics (Ursiri, Sanchez 2008), which counters the previous effect and makes the result in mathematics non-significant [7,8].

However, this conclusion should be regarded in a cautious way. The conclusion is derived from data of Mexican seventh-grade students; thus, it cannot show long-term effects of computer or Internet usage; also, their effects might change for different age groups or people who live in different places. Future researchers may regard these drawbacks and make better, more universal conclusions.

## REFERENCES

- [1] Bando, R., Gallego, F., Gertler, P., & Romero, D. (2016) Books or Laptops? The Cost-Effectiveness of Shifting from Printed to Digital Delivery of Educational Content. [https://www.nber.org/system/files/working\\_papers/w22928/w22928.pdf](https://www.nber.org/system/files/working_papers/w22928/w22928.pdf)
- [2] Wainer, J., Dwyer, T., Dutra, R. S., Covic, A., Magalhães, V. B., Ferreira, L. R. R., ... & Claudio, K. (2008) Too much computer and Internet use is bad for your grades, especially if you are young and poor: Results from the 2001 Brazilian SAEB. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.585.8576&rep=rep1&type=pdf>
- [3] Shahibi, M. S., & Rusli, K. N. (2017) The influence of internet usage on student's academic performance. *International Journal of Academic Research in Business and Social Sciences*, 7(8): 873-887.
- [4] Bulman, G., & Fairlie, R. W. (2016) Technology and education: Computers, software, and the internet. [https://economics.ucsc.edu/research/downloads/Fairlie\\_TechEduComp\\_102015.pdf](https://economics.ucsc.edu/research/downloads/Fairlie_TechEduComp_102015.pdf)
- [5] Akhter, N. (2013) Relationship between internet addiction and academic performance among university undergraduates. *Educational Research and Reviews*, 8(19): 1793-1796.
- [6] Sestak, J., Hughbanks, R., & Whitacre, B. (2020) Do Home Computers/Internet Access Affect Student Performance? <https://extension.okstate.edu/fact-sheets/do-home-computers-internet-access-affect-student-performance.html>
- [7] Freeman, C. E. (2004) Trends in Educational Equity of Girls & Women. National Center for Education Statistics, Washington, DC.
- [8] Ursini, S., Sánchez, G. (2008) Gender, technology and attitude towards mathematics: A comparative longitudinal study with Mexican students. *ZDM Mathematics Education*, 40: 559–577.