The Impact of Digital Innovation on Education in Romanian Education

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Abstract: Due to the accelerated pace of information and communication technology developments, the digital society and the digital economy have become real and, in turn, pose specific challenges. In this environment, digital skills and competences are essential to achieve the professional success and personal development of any individual. The positive impact that information and communication technology has on education cannot be disputed, but there are also some obstacles that need to be overcome in order to make the most of these benefits. An essential aspect to consider is that technology has repercussions not only on pupils and students, but also on teachers, who must adapt and acquire the knowledge necessary to disseminate information.

Having as the main objective of reflecting the impact of digitalization on the educational sector, the paper highlights the basic concepts in the field of digital technology and, at the same time, the current implications on educational processes. At the same time, through logistic regression, the way in which the means of digital innovation influence the education in Romania is analysed and to determine the factors with the highest degree of influence.

Modern technology can be considered as synonymous with the future and that is why it is essential that all young students acquire the digital knowledge necessary to revolutionize the educational process and at the same time redefine the recruitment of the labour market.

Keywords: *Digital innovation, Education, Logistic regression, Digital competences.*

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1. Introduction

Information and communication technology is a topic of interest in today's society, but concerns about identifying easy means of communication between people existed even in the period before our era. Therefore, we can say that information and communication technology was born with the birth of the human race, there are four defining periods, which marked the way it developed.

Figure 1 - Periods of information and communication technology evolution

Source: Own realization using Microsoft Word

People first discovered the means of communication in the Pre-Mechanical period. They began to use language to express and interact, but also some primitive drawings, often carved on rocks, known today as petroglyphs. Subsequently, these modes of communication evolved, laying the foundations of the Phoenician alphabet, which later contributed to the development of modern writing systems, such as the Latin, Arabic, Hebrew, Greek, etc. alphabets. The appearance of language led to the development of pen and paper, and out of the need to preserve the information transmitted, the first books and libraries began to be built. The numbering system also has its origins in the Pre-Mechanical period.

However, major communication advances were made during the Mechanical period. Several important events in this regard were reproduced by the invention of the ruler, used to perform mathematical calculations such as multiplication, division, power, and a mechanical computer, called Pascaline, after its "author", the French mathematician and philosopher, Blaise Pascal. Another great discovery also dates back to this period. It is the first programmable calculating machine, discovered by the English mathematician Charles Babbage.

An important evolution of technology was also recorded in the Electromechanical period, which marks the beginnings of telecommunications. The telegraph was first created, and for the transmission of messages through it the Morse code was developed, a series of sequences that included short and long signals. Some of the technologies of the modern era were born during this period. It is about the telephone, one of the most popular means of communication, and radio, discovered by

Alexander Graham Bell in 1876 and Guglielmo Marconi in 1894, respectively. digital Complex Number Calculator (CNC) [3].

The development and evolution of information and communication technology has had a significant impact on all sectors of activity. Although it is in a process of continuous transformation, the field of information technology is one of the most dynamic and competitive sectors in the world economy [12].

The 21st century is often seen as the age of technology, as it affects every aspect of everyday life to some extent, and education is certainly no exception. Technology is considered by many to be a factor with a positive influence on the way we think, obtain, interpret and process information, but at the other end of the spectrum, there are conflicting opinions about the impact that technology has on our lives [9].

However, there is no denying that technology has had a significant impact on all areas of activity, thus contributing to increasing productivity in almost every industry in the world.

A considerable number of the global population does not have access to quality education, but with the help of the internet this can become possible, and young people will have the opportunity to benefit, in this way, not only from access to basic information and knowledge, but also from and advanced subjects, which will contribute considerably both to their cultural formation and to the development of their own personality. Of course, in order to materialize this plan requires very large financial resources, a solid infrastructure, but also the involvement of the authorities, as not all the world's population can afford to own a computer or simply a smart device or the costs of internet subscription exceed much of the monthly budget available due to modest incomes. The use of computers and, implicitly, the Internet does not necessarily guarantee the improvement of the academic performance of pupils and students, but it does help to develop their digital skills.

The best way to develop digital-based behavior is through education. To ensure that pupils and students actively participate in activities aimed at their digital education, it is necessary to focus on certain notions and concepts that underlie the field of information and communication technology, such as digital commerce, communication and digital literacy, digital health, digital security etc. [16].

Using the means of digital innovation to engage pupils and students in activities that require the application of critical thinking processes in order to solve problems and increase collaboration between them are just a few examples of such benefits [11].

Currently, in high schools, but especially in universities, the use of digital innovation is encouraged to successfully carry out more complex and time-consuming activities. Without the use of technology, both in Romania and in the rest of the world, in the context of the Coronavirus Pandemic, the school year would have been canceled, and pupils and students would have faced a huge loss. Although the online education system is in its infancy in our country and has many gaps, it has fulfilled its main purpose, namely not to interrupt the dissemination of information to pupils and students [18].

In some situations, it may be premature to assume that the use of technology has a major beneficial impact on learning and development, as many young people fall into the trap of the illusion that modern technology has the answers to all of humanity's problems.

Students tend to focus on smart devices and pay more attention to them than is necessary during class or even at home when they have homework or projects to do. Technology can therefore negatively influence students' academic performance, affecting their concentration and school results [19]. In addition, without the support of parents and teachers, the skills needed to handle technological tools cannot be acquired.

The adoption of digital media in the field of education may create problems in the labor market in the future. Teachers may be replaced by smart devices or applications, and students will no longer have to go to school to learn. These circumstances of a negative nature also impact the individual from a psychological point of view, by repressing emotions and moving away from the characteristics that define our species.

2. Problem Statement

The growth and development of countries and societies is often strongly associated with the adoption and use of information technology [5]. The digital divide between countries can also be explained in terms of geographical positioning, as shown by Cruz in his study [5], in which two countries at opposite ends of the geographical spectrum were chosen as landmarks: Bulgaria and Portugal. Although both countries are part of the European Union, they have joined in different contexts and times.

The effect with negative nuances most often debated, produced by the excessive use of technology, is addiction. Researchers show that spending a very large number of hours in front of a computer or phone has both physical and mental repercussions on our health. A study conducted in 2017 on a sample of a population of young people aged between 19 and 32 years revealed that people who spend a very high number of hours online are more prone to isolation and social distancing compared with other

people in the same age group, with moderate or reduced use. More serious consequences such as anxiety or depression can occur as a result of abuse of the means of communication and transmission of information. Sometimes, the dependence created by the excessive use of modern technological means can lead to loss of self-control, neglect of personal status and degradation of interpersonal relationships [1]. According to the study, the most exposed category of people at this type of risk are, according to the study, students.

Although the negative aspects of technology are reduced numerically, their intensity differs depending on the person and how he is able to control them. A correct and gradual use of information and communication technology can certainly redefine and facilitate the way of life of the human race. The importance of technology in the life of each of us is an aspect that cannot be disputed. Therefore, this study aims to highlight the perception of Romanian students on how technology affects one of the most important topics in their lives, namely education, a period in which the character of a human being is shaped, psychologically and morally [2; 8].

The traditional concept of schooling, based on the development of teaching activities in a classroom, with a teacher whose main purpose is the transmission of knowledge and their acquisition by a group of students, is becoming increasingly uncertain [10]. As the use and evolution of technology is on a curve with a strong upward trend, it is expected that technology will play a more important role in educational activities as well.

Students born between 1982-2000 are classified as the millennial generation or Generation Y (Gen-Y), often being described as digital natives due to the fact that their birth coincides with the period of prominent prominence of the Internet and mobile technologies [14; 15]. They are defined by a high degree of technological literacy, and therefore one of the essential characteristics of digital natives is multitasking [4]. Passionate about computer games and the use of social networks, they are defined by flexibility and thus position their area of activity in several points. Therefore, they cannot be considered followers of the passive learning type, in which constructive feedback is completely lacking. Howe and Strauss (2003) suggest that Generation Y is distinguished by a number of traits such as goal-orientation, team spirit, conventionalism, trust, and caution [7]. But today, most young students are now part of the generation of 1995-2010, generically called Generation Z or abbreviated Gen-Z [17]. The members of this generation possess special characteristics, springing from the privileges of experimenting with web graphics technologies, the rise of mobile devices, but also cloud computing. The preferred way of communication of generation Z is through social networks, avoiding direct human contact, and

its uniqueness is reflected by the fact that it is the first generation that was offered the chance to be born in a digitalized universe, fully integrated and connected globally with the help of the internet. Generation Z's learning style is different from that of digital natives. The need for quick content access and visual memory are just some of its basic features. Young people in this generation learn better by implementing concepts in practice than by the power of example. Adapting to a new style of learning and teaching coupled with the application of technology in school activities is also mandatory for teachers, who have as pupils or young students who are part of either Generation Y or Generation Z, for which modern technology is not only an accessory that facilitates the educational process, but also a way of life.

3. Aim of the research

Without the use of technology, both in Romania and in the rest of the world, in the context of the coronavirus epidemic, the school year would have been canceled, and pupils and students would have faced a huge loss.

These changes were accompanied by a certain degree of reluctance, both on the part of teachers and on the part of pupils and students, but they created the favorable framework for the development of methods of educational innovation. Digitization can play a key role in restarting the world economy due to the fact that it ensures the direct and efficient functioning of all essential sectors (health, administration, transport), including education, and also creates a favorable environment for real-time access. and useful information of strict necessity (didactic, medical, personal). Although the online education system is at the beginning of the road in our country and has a lot of gaps, it has fulfilled its main goal, namely not to interrupt the spread of information to pupils and students.

Currently, the education system has a wide range of possibilities designed to revolutionize the learning and teaching process in all schools. Artificial intelligence is working on a series of measures to allow access to education for people with disabilities. These procedures aim to eliminate the need to involve the human factor in the education process, so that the pupil or student in question adjusts the pace of learning according to his ability and possibility. Also, by implementing such methods significantly reduces the level of anxiety that plays an important role in the education of people with disabilities [13].

The main objective of the paper is to highlight the factors that determine a behavior of students inclined to digitization and to what extent each of them contributes, using quantitative methods of data analysis, not

just how technology influences the educational process (positive or negative).

4. Methodology. Data

The study is based on a survey conducted in 2017, entitled "2nd Survey of Schools: ICT in Education", for a number of 28 European countries, including Romania [6]. The target population consists mainly of middle and high school students from about 400 schools, but the questionnaire was also attended by teachers and parents. The analysis made in this paper will be presented from the perspective of the student. For a start, the database was cleaned up by removing both non-answers and questions that students refused to answer ("prefer not to say"). No methods of replacing missing values, such as the multiple imputation method or the classical replacement of non-responses with the mean, were not considered for this study, as they would have influenced to some extent the veracity of the answers. Next, we selected some questions considered relevant for the realization of a logistic regression model whose purpose is to determine the factors that have a significant impact on the "digitization" behavior of students¹.

The variables of interest refer, first of all, to the age and sex of the responding students (1 - Female, 2 - Male), but also to the number of smart devices that they have outside the school units and that they implicitly use. Other factors that we took into account in conducting the study are:

- How often students access the Internet to watch videos and download music (1 - Never or almost never, 2 - Several times a week, 3 - At least once a week, 4 - Every day or almost every day);
- Frequency of using social networks and accessing educational software;
- To what extent do students take advantage of the opportunity to have access to the Internet to search for information related to school and how often do they access their personal computer or smartphone in order to carry out various, educational experiments;
- How often students participate in online learning programs (e-learning);
- Students' opinion on how technology influences the learning process (helps them to retain information much more easily: 1 - Influences to a large

¹ 1 - digitally active students, inclined to use modern means of technology to solve problems of an educational nature or for any other purpose, and 0 - less digitally active students, with moderate or low inclination to use the means digital in everyday life.

extent, 2 - Influences somewhat, 3 - Influences to a small extent, 4 - Does not influence at all);

- The degree of encouragement by teachers to use the digital skills that students have to facilitate the educational process (1 - No encouragement, 2 - Low degree of encouragement, 3 - Moderate degree of encouragement, 4 - High degree of encouragement).

We will apply the logistic regression model, having as dependent variable the binary variable *digitally*. Independent variables will be considered all categorical and numerical variables presented in this study, respectively.

The logistic regression model with the equation:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta_i x_i, \quad i = \overline{1,27}, \quad (1)$$

has the following features:

- ODDS ratio = $\frac{p}{1-p}$ (2);
- the coefficients of the explanatory variables in the regression model: $\beta_i x_i, \quad i = \overline{1,27}$ (3);
- the probability of an event occurring

$$p = \frac{e^{\alpha + \beta_i x_i}}{e^{\alpha + \beta_i x_i} + 1} = \frac{1}{1 + e^{-(\alpha + \beta_i x_i)}}, \quad i = \overline{1,27} \quad (4).$$

4.1. The use of modern technologies in Romanian schools

Based on the data extracted for Romania following a survey conducted at European level, we made a short profile of the students participating in the questionnaire. Most of them are enrolled in the gymnasium cycle, and the predominance of male students is obviously visible. Although the continuity of the high school cycle is natural after completing primary and secondary education, very few students choose to follow the path of a post-secondary school [6]. The main objective of this questionnaire is to characterize students in terms of their digital skills. The aim of this survey is also to identify students' technology preferences, as well as the extent to which classrooms are equipped with the smart devices needed to carry out teaching more easily.

In Romanian schools, digital innovation is used in a significant percentage in learning and teaching subjects related to information technology (programming and ICT), mathematics, foreign languages, natural sciences, etc. However, there are also topics that do not require the use of information media to be taught and assimilated.

Figure 2 - Distribution of respondents by gender and educational level

Source: Own realization using Microsoft Excel

Most Romanian students know how to use modern means of technology to a moderate to high extent. However, there are also young people who do not have digital skills or are characterized by limited computer or internet skills. This may be due to the financial situation of parents, who cannot afford to invest in digital technology. However, there is a clear trend of improving digital skills compared to previous generations, as, as mentioned above, most young students are part of Generation Z.

Figure 3 - The extent to which young students are able to use modern means of communication

Source: Own realization using Microsoft Excel

5. Findings and Discussions

The survey was conducted among European Union member states, Norway, Iceland and Turkey. The sample extracted has a volume (n) of

approximately 49000 young people aged between 10 and 18 years, from 400 primary, secondary, high school and post-secondary education units. The survey conducted is a simple random return, because the sample volume is smaller than the population volume multiplied by 0.05.

The average age of the respondents is 15 years, and the standard deviation from the average is 1.91, which means that the age of the subjects deviates from the average by about 2 years. 25% of the students who participated in this survey have less than four electronic devices, and 75% of them stated that they have more than four smart devices at home (Annex 1, Table 1).

From a graphic point of view, it is observed that the age of the students follows an approximately leptocurtic, sharp distribution, whose elongated tails may be due to the presence of extreme values (Figure 4.a). The distribution of the number of electronic devices is not close to the normal distribution either, being instead a disproportionate, platikurtic one (Figure 4.b).

Figure 4. Distribution of the numerical variables "Age" (a) and "Number of electronic devices" (b)

Source: Own realization using Microsoft Excel

The variables "age" and "number of smart devices" are weakly and positively correlated (Annex 1. Table 2), so that the influence between the two is not as strong as we would have expected.

Among the students responding to the survey, the predominant is the number of males (51.49%). It should be noted that the proportion of students participating in online learning programs, e-learning, is quite high (42.25% of students have accessed e-learning platforms at least once), which

can be seen in the graph below, and a significant percentage of them (30.47%) use the Internet at least once a week to document the topics covered at school (Annex 1. Table 3).

However, most respondents use technological means to listen to music, play video games or communicate on social networks. The degree of encouragement shown by teachers regarding the use of information and communication technology to solve educational problems is moderate to high.

Figure 5. The degree of student participation in online learning programs

Source: Own realization using Microsoft Excel

It should be noted that most students who participated in the survey believe that the use of modern technology has little or no influence on the learning process, especially the retention of information. There are no differences of opinion between the two sexes. These results may be due to the fact that in schools and high schools in Romania has not yet been promoted and adopted a learning and teaching behavior based on information and communication technology, which takes place mainly in higher education institutions (undergraduate cycles, masters, doctoral schools etc.).

Analyzing the results presented in Table 4 (Annex 1), intuitively, we find that the factors that have a statistically significant impact on students' digitization behavior are age, the number of smart devices they have, the frequency of software use educational services and access to e-learning platforms (at least once a week or daily), but also the degree of use of the computer or smartphone in order to perform experiments for educational purposes etc. The gender of students is not a factor that influences their tendency towards digitalization. In other words, due to the fact that various

categorical variables with multiple response variants were included in the model, some of the regression coefficients for these variants are not statistically significant. The regression model is valid, as the probability of $4.967205e - 184$, generated using the RStudio program, is lower than the chosen significance level, $\alpha = 0.05$.

The analysis of the results will be performed by interpreting the regression coefficients presented in Table 5 (Annex 1). It reveals that if the age of responding students increases by one year then the probability that they will develop in the future a behavior inclined to digitization increases by 1.197, more precisely by 19.7% (assuming that the other variables in the model remain constant). In addition, if the number of smart devices that a student owns and implicitly uses outside of school or high school increases, then the probability that he will tend to use them for educational purposes may be 1.551 times higher. Students who use specialized educational software at least once a week or every day are more likely to develop digital behavior than those who use the Internet to watch videos, movies, and listen to music. Teacher support plays an important role in encouraging students to develop and use their digital skills, as the results of this study show that a high degree of encouragement increases the likelihood that students will use technology in the future for educational purposes or to solve problems in everyday life. For young students who believe that technology does not revolutionize in a positive way and has absolutely no impact on how they learn and carry out educational activities, the probability that their digital behavior will be shaped over time decreases by about 10%.

To evaluate the performance of the estimated regression model it is necessary to create the "Confusion Matrix" (Annex 1. Figure 6). First it is necessary to split the data set into training data and test data. The test database will contain 30% of the existing observations in the initial data set and will be generated through a random selection process. Of the 556 observations, 303 students were correctly classified in the group of less active young people from a digital point of view, while a number of 150 students were correctly included in the group of students with a high propensity to digitize. The accuracy of the model is 81.47%, which is why we can conclude that the predicted model is a good one. Sensitivity has a percentage of 68.81%, which means that approximately 69% of the interviewed students have a predilection for the use of information and communication technology for educational purposes, being correctly predicted through the model. Regarding the specificity, for this we have a percentage of 89.64%, so that the model correctly predicts in this proportion

the students who have a moderate or low inclination towards the use of digital means.

The quality of the model can also be investigated using the ROC (Receiver Operating Characteristic) curve, which evaluates the relationship between the real positive rate (sensitivity) and the false positive rate (specificity) (Annex 1. Figure 6). The area under the curve has a fairly generous size in the case of the estimated model, so we can say that it is a high-performance one, fulfilling its purpose for which it was created.

6. Conclusions

Educational training is an essential step in shaping a person's character and often the skills that an individual acquires from childhood or on school benches define and guide his entire existence. The century we live in is predominantly dominated by digital natives, also known as Generation Y, and young people belonging to Generation Z. They have a high inclination towards digitalisation and are characterized by special elements, such as a high level of digital literacy, multitasking and active learning, and as a result teaching methods must be adapted to their style. The challenges of the digital age are thus largely addressed to teachers and parents, who need to learn medium-level technological knowledge and skills so as to ensure that young people use digital media appropriately and safely.

Information and communication technology contribute positively to the facilitation of the teaching process, by providing the necessary resources to learn and encourage the use of software programs intended exclusively for educational purposes. But the biggest benefit that technology brings in a person's life is unlimited access to any type of information, anytime and from anywhere. However, as demonstrated by analyzing the responses of a group of students to a questionnaire conducted at European level, not all young people born in the digital age have intermediate or advanced digital skills, as the financial situation of parents or the infrastructure of the schools where they learn. does not allow access to computers or any other type of smart devices and the internet.

The quantitative method chosen for the analysis of the digitization behaviour of the students is the logistic regression. The classical linear regression model, based on the Least Squares Method, is not suitable because the factors used in the analysis are a mix of qualitative and quantitative data, and the variable to be predicted is binary. Following a descriptive analysis, we found that each student has at least one smart device at home that he uses, and more than half of them have more than five electronic devices. There is a positive correlation between the age of the

respondents and the number of devices they have, but the intensity of the connection is weak.

Although most young people use technological means to communicate through social networks and listen to music or watch movies, there is a significant percentage of students who access educational programs and online platforms dedicated to this. In addition, about 30% of them stated that they use the internet to search for information related to the problems presented at school, such as homework, projects, essays etc.

The digitalization of the educational process is still at the beginning of the road in Romania, and this is also reflected in the students' answers regarding the way in which technology influences the learning process. Many students say that technology helps them to a small extent or not at all to retain various information when preparing for a test or exam. Digital teaching methods are mainly adopted in universities and less in middle schools or high schools.

Following the estimated regression model, it was concluded that most of the factors involved in the analysis have a statistically significant influence on the digitization behaviour of students. Among them we mention the age, the number of smart devices that students have in their possession, the frequency of accessing e-learning platforms, at least once a week or daily, and the degree of use of computer or smartphone to perform experiments in educational purposes. Interestingly, sex is not a “cause” factor in determining the “effect” situation, and young people who believe that technology has no impact on how they learn are about 10% less likely to develop than other students. a consolidated behaviour on digitization. The high degree of encouragement shown by teachers regarding the use of digital skills for educational purposes or for solving everyday problems, as well as the frequent use of educational software, increase the likelihood of developing digital behaviour.

The estimated model proved to be statistically valid, with an accuracy of about 82%, which is why we can deduce that it is a high-performance, but also useful. The results of this study can be used to contribute to the development of technology-based education in schools and high schools. Modern technology can be considered as well synonymous with the future and that is why it is essential that all young students acquire the digital knowledge necessary to revolutionize the educational process and at the same time redefine the recruitment of the labour market. The replacement of humans with robots is not the result that is intended to be achieved through the exploitation of technology, but the goal is to develop as humans, as a personality, to carry forward the specifics of the human race.

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Annex 1

Table 1. Descriptive statistics for numerical variables
in the database used in the analysis

variabla	mean	sd	IQR	0%	25%	50%	75%	100%
age	15.564019	1.916241	4	11	14	15	18	18
devices	5.661804	2.532202	3	0	4	5	7	11

Source: Own realization

Table 2. Correlations between the numerical variables existing in the database used

	age	devices
age	1.00000000	0.06094352
devices	0.06094352	1.00000000

Source: Own realization

Table 3. Absolute and relative frequencies
of the categorical variables used in the analysis

educationalsoftware	1	2	3	4
counts:	496	581	451	323
percentages:	26.8	31.39	24.37	17.45
elearning	1	2	3	4
counts:	1069	419	233	130
percentages:	57.75	22.64	12.59	7.02
entertainment:	1	2	3	4
counts:	113	335	364	1039
percentages:	6.1	18.1	19.67	56.13
experiment:	1	2	3	4
counts:	393	532	431	495
percentages:	21.23	28.74	23.28	26.74
gender:	1	2		
counts:	898	953		
percentages:	48.51	51.49		
learningcompetences:	1	2	3	4
counts:	369	248	924	310
percentages:	19.94	13.4	49.92	16.75
schoolinfo:	1	2	3	4
counts:	233	506	564	548
percentages:	12.59	27.34	30.47	29.61
socialmedia:	1	2	3	4
counts:	133	245	197	1276
percentages:	7.19	13.24	10.64	68.94
techimpact:	1	2	3	4
counts:	74	212	612	953
percentages:	4	11.45	33.06	51.49

Source: Own realization

Table 4. Estimated logistic regression model (RStudio)

Coefficients:	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-9.09071	0.85028	-10.691	< 2e-16 ***
age	0.18016	0.03458	5.210	1.89e-07 ***
devices	0.44519	0.03203	13.900	< 2e-16 ***
educationalsoftware[T.2]	0.26248	0.18931	1.387	0.165590
educationalsoftware[T.3]	0.92251	0.19219	4.800	1.59e-06 ***
educationalsoftware[T.4]	1.73782	0.21768	7.983	1.42e-15 ***
elearning[T.2]	0.43903	0.16037	2.738	0.006188 **
elearning[T.3]	1.45672	0.21320	6.833	8.33e-12 ***

Coefficients:				
	Estimate	Std. Error	z value	Pr(> z)
elearning[T.4]	1.38061	0.29823	4.629	3.67e-06 ***
entertainment[T.2]	0.36147	0.41478	0.871	0.383495
entertainment[T.3]	0.49568	0.40899	1.212	0.225531
entertainment[T.4]	1.06304	0.39459	2.694	0.007058 **
experiment[T.2]	0.32148	0.21066	1.526	0.126994
experiment[T.3]	0.71703	0.21194	3.383	0.000716 ***
experiment[T.4]	1.02320	0.20592	4.969	6.73e-07 ***
gender[T.2]	0.11834	0.13559	0.873	0.382756
learningcompetences[T.2]	-0.31274	0.23005	-1.359	0.174011
learningcompetences[T.3]	-0.06980	0.17870	-0.391	0.696088
learningcompetences[T.4]	0.42422	0.21724	1.953	0.050849 .
schoolinfo[T.2]	-0.33177	0.24891	-1.333	0.182567
schoolinfo[T.3]	0.02552	0.24093	0.106	0.915650
schoolinfo[T.4]	0.46080	0.24651	1.869	0.061587 .
socialmedia[T.2]	-0.23442	0.38285	-0.612	0.540340
socialmedia[T.3]	0.92583	0.37779	2.451	0.014259 *
socialmedia[T.4]	0.93642	0.33540	2.792	0.005239 **
techimpact[T.2]	-0.45823	0.38167	-1.201	0.229910
techimpact[T.3]	-0.15257	0.34730	-0.439	0.660438
techimpact[T.4]	-0.09612	0.33823	-0.284	0.776273

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Source: Own realization

Table 5. ODDS ratio for variables used in estimating the logistic regression model (RStudio)

	ODDS ratio
Intercept	0.000112708
age	1.197406822
devices	1.560782460
educationalsoftware[T.2]	1.300147105
educationalsoftware[T.3]	2.515604605
educationalsoftware[T.4]	5.684947551
elearning[T.2]	1.551199141
elearning[T.3]	4.291857039
elearning[T.4]	3.977338990
entertainment[T.2]	1.435441516
entertainment[T.3]	1.641610350
entertainment[T.4]	2.895169701
experiment[T.2]	1.379173353
experiment[T.3]	2.048337160
experiment[T.4]	2.782079539
gender[T.2]	1.125632090
learningcompetences[T.2]	0.731440156
learningcompetences[T.3]	0.932578451
learningcompetences[T.4]	1.528394310
schoolinfo[T.2]	0.717650477
schoolinfo[T.3]	1.025846645
schoolinfo[T.4]	1.585333828
socialmedia[T.2]	0.791032594
socialmedia[T.3]	2.523966671
socialmedia[T.4]	2.550826951
techimpact[T.2]	0.632402845
techimpact[T.3]	0.858496491
techimpact[T.4]	0.908357108

Source: Own realization

```

Confusion Matrix and Statistics

      Reference
Prediction 0  1
0      303  68
1       35 150

      Accuracy : 0.8147
      95% CI   : (0.7799, 0.8462)
      No Information Rate : 0.6079
      P-value [Acc > NIR] : < 2.2e-16

      Kappa : 0.6007

      Mcnemar's Test P-value : 0.001616

      Sensitivity : 0.6881
      Specificity : 0.8964
      Pos Pred Value : 0.8108
      Neg Pred value : 0.8167
      Prevalence : 0.3921
      Detection Rate : 0.2698
      Detection Prevalence : 0.3327
      Balanced Accuracy : 0.7923

      'Positive' class : 1
    
```

Figura 6. Confusion Matrix

Source: Own realization using RStudio

Figura 7. ROC curve

Source: Own realization using RStudio