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TEACHERS' PERCEPTION OF SMARTPHONE USE IN RURAL SECONDARY SCHOOLS DURING THE COVID-19 PANDEMIC

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ABSTRACT

In the context of the pandemic caused by COVID-19, schools in 183 countries had to close at all academic levels and the only alternative was distance education, using electronic tools that allow synchronous and asynchronous communication, such as Smartphones. The purpose of the research was to determine the influence of the pedagogical use of Smartphones on academic performance and virtual education in secondary and technical secondary schools in rural educational institutions in the municipality of Toledo, Norte de Santander, Colombia, during the 2020 pandemic. The survey technique was applied to collect data using as an instrument a questionnaire of 24 questions on a Likert scale, additionally the qualifications were taken in five key areas of the population consisting of five educational institutions in the municipality of Toledo, Norte de Santander department, the study was applied, quantitative approach, non-experimental design, correlational level, the data were processed statistically using SPSS V25 software, allowing to observe the significant influence that has the pedagogical use of Smartphone in academic performance and virtual education in rural educational institutions in the middle of the pandemic 2020.

Keywords: Rural Schools, Synchronous Communication, Asynchronous Communication, Smartphone, Academic Performance, Virtual Education.

1. INTRODUCTION

The massive use of Smartphone has intensified in recent years in all spheres of society, particularly by young people and children from a very early age, as well as in different urban and rural scenarios DANE (2018). Globally according to ITU (2018) there are more active cell phone lines than people, since for every 100 people there are 107 active cell phone lines and in some countries this ratio has increased significantly, as is the case of Colombia where there are 129.91 cell phone lines per 100 inhabitants and according to DANE (2018) in rural areas, although there are difficulties of connectivity and access the network 58.3% of people over 5 years old have a cell phone and mostly a Smartphone. It is here the concern that this device can be used pedagogically by teachers, children and young people, by integrating it into the curricula of the I.E. Briede et al (2015), taking up what Siemens (2005) says in the theory of

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the connectivist approach where the use of these emerging technologies should be taken advantage of pedagogically. This pedagogical proposal that gave rise to e-learning (Downs 2005) allowed improving traditional distance learning to the point that it actively integrated the student in the construction of their own learning; however the growing society and increasingly demanding tools that allow greater ubiquity and portability of learning found in mobile devices those alternatives that would allow a more continuous and adaptable learning not only to the mobility of people but as expressed by Kakihara & Sorensen (2002) three fundamental aspects of mobility should be integrated which are: temporal, spatial and contextual. It is then when the concept of the mobile-learning modality begins to gain spaces in the academic field giving rise to the learning modality called ubiquitus-learning or ubiquitous learning; this concept had already been studied and worked for several years Jones and Jo (2004), building personalized learning models adjusted to the needs of each student Paramythis & Loidl-Reisinger (2004) cited by Velandia-Mesa et al. (2017).

However, in Colombia, situations of misuse of Smartphones and other mobile devices by children and young people have been analyzed, motivating to legislate the prohibition of the use of Smartphones and other mobile devices at school by children and young people under 14 years old, when the reality is that more than 76% of young people between 12 and 17 years old have their own Smartphone and with voice and mobile data MinTIC (2015). This fact opened the national debate when the bill restricting the use in school of mobile devices was filed at the beginning of 2019 in Congress, finding support by some political sectors having as a reference the measures taken in France and rejection by some education academics, Semana, (2019). This debate was paused when the health emergency caused by the Covid-19 pandemic began, due to the fact that educational institutions had to be closed at all academic levels and in all places, taking as an alternative remote education from the homes of both teachers and students, according to UNESCO (2020) approximately 185 countries closed their schools and suspended face-to-face classes throughout their territories and at all academic levels due to the health emergency.

The u-learning modality increased exponentially worldwide, using the Smartphone as the main technological mediator; this modality has become the precise alternative in the Covid-19 Pandemic, to supply the educational needs of children and young people particularly in public institutions located in rural environments in Colombia where there is greater access to a Smartphone than to a laptop computer DANE (2018). The above situation led to raise as a fundamental purpose of the present research to determine the influence of the pedagogical use of the Smartphone on academic performance and virtual education in high school, in rural educational Institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic; thus allowing to know firsthand the perceptions that teachers of Rural Educational Institutions have of the good use that can be given to the Smartphone as a pedagogical tool in the teaching-learning processes even in rural areas where difficulties persist in connectivity and access to technology.

In the literature review work, similar research was found such as Lagunes et al. (2017), Leon (2017), Melo (2017), Poyatos (2017), Rentería & Ayala, (2017), Arenas, (2018), Pinos et al.

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(2018), Vilches & Reche, (2019), Mangisch, G. & Mangisch, M. (2020), among other research on the educational use of mobile devices, however most of these investigations were carried out in university contexts and few in institutions of basic secondary education; likewise almost all of these investigations mentioned the environment was in universities and schools located in urban areas where there is greater access to technological devices and greater capacity for internet connectivity is here the relevance of this research that was developed in a rural context with all the difficulties and limitations that this frames.

2. LITERATURE REVIEW

2.1 Theories that support the pedagogical use of the Smartphone

The research had its theoretical foundations in the connectivist approach, which bases its concept on the creative capacity of the human mind to acquire knowledge through learning adaptable to the surrounding context (Siemens & Conole, 2011). The theory of connectivism is not an idea that arose without epistemological foundation since its strongest origins are in the ideas of psychology and pedagogy from authors such as Bruner, (1966); Ausubel, (1964); Piaget, (1954); Vygotsky, (1932), among other authors, who with their constructivist models inspired the connectivist approach.

This pedagogical approach has as its greatest exponent Siemens, (2005) when he proposed it as a network learning theory taking advantage of emerging technologies that allowed remote connections through the Internet, however Downs, (2005) developed the idea of integrating the nascent web 2.0 to teaching originating the so-called e-learning 2. 0, a modality that due to its limitations in mobility and portability because computers, even if they were portable, did not facilitate student mobility, gave way to Mobile learning, a modality that has as its main element mobile devices, particularly Smartphones; this pedagogical modality supports student-centered learning since students participate directly and actively in the construction of their own learning being able to create and share content with other learners, through the use of their mobile devices (Sanchez et al., 2019).

2.2 Academic performance

To recognize the concept of academic performance, a scrutiny should be given to the activity theory, which has its antecedents in classical German philosophy, particularly in the writings of Marx and Engels, as well as in the sociocultural approach psychology of Vigotsky, (1932) as referenced by Brazuelo and Gallego, (2012). In terms of this sociological theory, human development can be seen as a cultural construction within a structured social system, which is achieved through the realization of shared social activities guided by education; this means that culture and society are given great importance as determining factors in the process of personal development.

Thus, from this sociological perspective, the acquisition of knowledge is mediated by the efficient application of pedagogical and didactic tools, as well as the development of mental schemes, which go beyond the mere transmission of knowledge. This pedagogical orientation views learning actions as social, applied and shared activities performed by a given person on

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a particular object, all motivated by stimuli or needs to achieve clear and preset goals Brazuelo and Gallego, (2012); in other words, learning is thought of as a mediated activity, by tools that stimulate and favor it, among which in full society 3.0 mobile devices connected to the Internet, such as the Smartphone, are on a fairly high platform.

From another perspective Edel, (2003) approaches academic performance as a construct that can show quantitative and qualitative data, through which it approaches the reality in terms of competence, knowledge, attitudes and values that have been achieved by the student during the entire teaching-learning process in a certain period of time, referring to the grades obtained. From a more generalized conception, academic performance can be perceived as the convergence of a large number of qualitative and quantitative variables that can be grouped into two groups, personal and contextual Pérez & Gallego, (2011).

2.3 Concept of virtual education

Advances in the development of information and communication technologies-ICT have allowed the emergence and strengthening of distance learning modalities, without the limitation of time or space, where the teacher can interact directly with students synchronously (in real time) through online meetings and videoconferences or asynchronously through LMS platforms, e-mail, WhatsApp, Messenger and in the same way students can do it among themselves.

The MEN (2010) defines virtual education as an educational process that takes place in a place other than the classroom, without the need for the teacher's body to be present in the immediate space of the student's body, this process is carried out through the Internet. From a more general point of view, virtual education goes beyond being an imaginary education as many think because it is not developed within a physical classroom, or uses virtual means, since in face-to-face education the same technological means can also be used, as expressed by MEN (2010) the difference lies especially in the way the teacher and students meet, which can be done anywhere as long as they have access to the internet since it will be available at all times, therefore it is not limited even by time. Therefore, virtual education needs the commitment of teachers to motivate, guide and provide feedback to students and the commitment of students to autonomously manage their own learning Roig-Vila (2016).

2.4 Reality of virtual and rural education in Colombia

Higher virtual education in Colombia has been in a continuous increase, particularly since 2010 when in Colombia according to the SNIES - MEN there were 9,758 students enrolled in virtual education, compared to 2018 in which enrollments of 200,170 students in virtual education are reported; while traditional face-to-face and distance enrollment has been decreasing MEN (2018). It is very good to remember that virtual education in Colombia started with the broadcasting of content or the so-called radio education, where the mediating instrument between the teacher and the student was the radio that was available at home. The first university that started with virtual and distance education exclusively in the country after virtual education was regulated around 1982 was the Unidad Universitaria del Sur (UNISUR)

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which later became the Universidad Nacional Abierta y a Distancia (UNAD), who were dedicated exclusively to distance education implementing virtual education, with the passage of time several universities in the country began to open distance and virtual programs at graduate and undergraduate level Yong et al., (2017), reaching today to reach a large number of higher education institutions in Colombia with virtual education; however virtual education is not only in higher education, in secondary education today there are numerous educational institutions that offer basic primary and secondary, as well as technical high school in a virtual way, initially these programs were for adults, allowing them to validate in a short time their studies, but today there are Colleges specialized in virtual graduate education for children and adolescents.

In rural areas there is a "technological fracture" as Soto & Molina, (2018) call the gap in terms of technological endowment of educational institutions, however, the national government has created flexible programs to allow people from rural contexts to access basic and middle technical studies, even so the desertion is quite numerous. However, in the study conducted by Soto & Molina, (2018) it is concluded that ICTs have a fundamental role in rural education and not only in the school, since it is necessary to resituate them throughout the rural sector to make educational strategies available to the entire community being engines of socio-educational and economic development for the countryside, particularly in these new difficult contexts that have been generated on account of the pandemic and health emergency.

2.5 Research Hypothesis Development

The topic addressed in this research has in itself a very broad relevance at national and international level, as it has been tried to demonstrate from the approach of the problematic reality. The use of mobile devices at school has been visualized by many teachers, school administrators, administrators of educational institutions, legislators at the level of the Colombian Congress, parents and the community in general as a problem that currently in Colombia has ignited the debate on whether to radically prohibit their use and use within educational institutions to students and teachers, or whether to regulate to allow their restricted use as teaching tools in the academic processes of teaching and learning within educational institutions. However, today with the closure of educational institutions nationwide, these devices have become an excellent communication and pedagogical resource in the process of virtual or distance education from the homes of students and teachers in the midst of social isolation. This has led to the following hypotheses.

H1: There is influence of the pedagogical use of the Smartphone, in the academic performance and virtual education in high school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the pandemic 2020.

H2: There is influence of Smartphone Access by teachers and students on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during pandemic 2020.

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H3: There is influence of the didactic use options offered by the smartphone on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during pandemic 2020.

3. RESEARCH METHODS

3.1 Population and Sample

For the research the population consisted of approximately 50 teachers who teach at least one of the five fundamental areas and of greater hourly intensity in the educational institutions, namely: Natural Sciences, Social Sciences, Spanish, English and Mathematics, of basic secondary and technical middle school in one of the five rural educational institutions in the municipality of Toledo, Department Norte de Santander, Colombia, which are: La Capilla Rural Educational Center, Santa Barbara Rural Educational Center, San Bernardo Educational Institution, Samore Educational Institution and Gibraltar Educational Institution. In this research, a non-probabilistic census sample by convenience was proposed as established by Hernández-Sampieri & Mendoza (2018), due to the fact that all members of the population were allowed to participate in the research; Table 1 shows the teachers who participated in the research by educational institution for the application of the instruments.

Table 1. Participating teachers by Educational Institution

Educational Institution	Código E.I.	Number of teachers
CER La Capilla	CLC	5
CER Santa Barbara	CSB	2
I.E. San Bernardo	ISB	15
I.E. Samore	IES	14
I.E. Gibraltar	IEG	14
Total		50

3.2 Measurement of Variables

A variable is an attribute that can be measured and observed Hernandez *et al*. (2014) & Arispe *et al*. (2020), so for the research three variables were defined to work, one independent and two dependent:

Independent Variable

Pedagogical use of the Smartphone: This variable refers to the didactic use of the Smartphone by teachers to integrate them into the teaching-learning processes, thus allowing the social interaction of the teacher with the students and among the students themselves. In

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order to use smartphones pedagogically, the teacher must know the availability of the equipment available to the students and the teacher himself, as well as the tools offered by the different applications. The above information was obtained by applying the survey technique through a questionnaire to the teachers of the complete and rural educational institutions of the municipality of Toledo, Norte de Santander.

Dependent variables:

Academic performance, refers to the grades that teachers give to students for their work developed in a certain period of time Edel (2003); for the present research the grades issued by teachers in five fundamental areas such as: Mathematics, Natural Sciences, Social Sciences, Spanish and English, during the year 2020.

Virtual education, MEN (2010) defines virtual education as any educational process that takes place outside the physical classroom, without the need for the physical presence of students and teachers, being cyberspace one of the most used options to sustain synchronous or asynchronous educational encounters. In order to carry out the educational process in the virtual modality, the four dimensions established by the Ministry of National Education must be addressed, which are: the pedagogical dimension, the technological dimension, the organizational dimension and the communicative dimension. For the present research this variable was through the application of a questionnaire to teachers where the incidence of the independent variable on the dependent variable was observed.

3.3 Validity and reliability of the instruments.

The research was submitted to and approved by the research committee of the Norbert Wiener University, the instruments were reviewed, complying with ethical standards and scientific rigour.

Instrument 1, Questionnaire: was adapted from others already worked and validated to evaluate the use of mobile devices in different educational scenarios proposed by Estrada (2014), Salcines & Fernández (2016), Brazuelo et al. (2017), Taquez *et al.* (2017), Seifert et al. (2019). The validity of the same was studied and validated by a panel of 10 expert judges, who hold doctoral degrees in education thus validating the content of the same through opinions and content observations that served as a reference to improve the questionnaire. The reliability of this instrument was carried out by means of a pilot test with 20 teachers who met the criteria of the target population, obtaining the values for Cronbach's Alpha shown in Table 2.

Table 2. Reliability index Instrument 1

Part of the instrument	Cronbach's alpha	N of items
Part 1	0,823	10
Part 2	0,828	14

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Instrument 2, Observation sheet: The validity of the ratings is established in the Institutional Evaluation System of each of the Educational Institutions, which are registered and approved in the departmental secretary of education of Norte de Santander under the guidelines of the Ministry of National Education, thus imprinting a solid validity that allows using the ratings data as a research instrument. The reliability of these data lies in the fact that they were provided by the teachers' managers directly from their grading platforms.

3.4 Data processing and analysis

For the processing of the data collected with the instruments described above, Microsoft Word software was used to process the texts, Microsoft Excel to organize the database and the IBM - SPSS v25 program for the processing and statistical analysis of the data. After the statistical processing of the data, the respective interpretations of these results were made, making it possible to confront the hypotheses initially proposed, to establish the discussion of results, conclusions and recommendations pertinent to the purpose of the research.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The data collected were analyzed the sample was composed of equal parts of men and women, i.e. 25 men and 25 women. As for the academic training of the men, 8, corresponding to 16%, were specialists, 7, equivalent to 14%, were masters and 10, equivalent to 20% of the sample, had no postgraduate degree; on the other hand, 15 women, or 30%, were specialists, 3, equivalent to 6%, were masters and 7, constituting 14% of the sample, had no postgraduate education of any kind.

The participation of the teachers by educational institution was as follows: in I. E. Gibraltar, 14 teachers participated, equivalent to 28%, of which 13 have more than 5 years of teaching experience; in I. E. La Capilla, of the 5 participating teachers, equivalent to 10%, all have more than 5 years of teaching experience; of the 14 participating teachers in I. E. Samore, equivalent to 28%, all have more than 5 years of teaching experience; of the 14 participating teachers in I. E. Samore, equivalent to 28%, all have more than 5 years of teaching experience; in I. E. La Capilla, equivalent to 10% of the participating teachers, all have more than 5 years of teaching experience I.E. Samore (28%), only 1 teacher has less than 5 years of teaching experience; of the 15 teachers (30%) who participated from I.E. San Bernardo, 4 have less than 5 years of teaching experience; finally, the 2 teachers (4%) who participated from I.E. Santa Barbara have more than 5 years of teaching experience.

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Descriptive analysis of the results of the variable Pedagogical use of the Smartphone

Table 3. Distribution levels of the dimension of the pedagogical use of the Smartphone

Dimensions	Low		Medium		High		Total	
	n	%	n	%	n	%	n	%
Smartphone access	9	18.0	24	48.0	17	34.0	50	100.0
Educational use	6	12.0	27	54.0	17	34.0	50	100.0

Table 3 shows that, of the total of 50 teachers surveyed, 9 of them, representing 18.0%, have a low level in the dimension access to the smartphone by students and teachers; 24 of the teachers surveyed, representing 48.0%, have a medium level and 17 teachers, representing 34%, have a high level. As for the second dimension corresponding to the didactic use of the smartphone, 6 of the surveyed teachers representing 12.0% have a low level; while 27 of the surveyed teachers representing 54.0% have a medium level in the use of the smartphone and 17 teachers representing 34.0% have a high level.

Descriptive analysis of the results of academic performance and its dimensions.

Table 4. Levels of distribution of the dimensions of Academic Performance

Dimension	Low		Básic		High		Superior		Total	
	n	%	n	%	n	%	n	%	n	%
Mathematics	0	0.0	0	0.0	50	100.0	0	0.0	50	100.0
Natural Sciences	0	0.0	4	8.0	44	88.0	2	0.0	50	100.0
Social Science	0	0.0	8	16.0	42	84.0	0	0.0	50	100.0
Spanish	0	0.0	14	28.0	36	72.0	0	0.0	50	100.0
English	0	0.0	10	20.0	40	80.0	0	0.0	50	100.0

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Table 4 shows that, of the total of 50 teachers, 100% perceive a high level of performance in Mathematics. As for the second dimension referring to Natural Sciences, 4, representing 8%, perceive a basic level; 44 of the teachers, representing 69.8%, perceive a high level; while 2 of the teachers, representing 4.0%, perceive a higher level. Regarding the third dimension referring to Social Sciences, 8 teachers representing 16% perceive a basic level; 42 of the teachers representing 84% perceive a high level. Regarding the fourth dimension, corresponding to Spanish, 14 teachers representing 28% perceive a basic level; 36 of the teachers representing 72% perceive a high level. Regarding the fifth dimension, corresponding to the subject of English, 10 teachers representing 20% perceive a basic level; while 40 teachers representing 80% perceive a high level.

Descriptive analysis of the results of the variable Virtual education.

Table 5. Levels of distribution of the dimensions of virtual education

Dimension	Low		Medium		High		Total	
	n	%	n	%	n	%	n	%
Pedagogical dimension	10	20.0	37	74.0	3	6.0	50	100.0
Communicative dimension	10	20.0	36	72.0	4	8.0	50	100.0
Technological dimension	0	0.0	31	62.0	19	38.0	50	100.0
Organizational dimension	28	56.0	20	40.0	2	4.0	50	100.0

Table 5 shows that, of the total of 50 teachers surveyed, 10 of them, representing 20%, show a low level in the pedagogical dimension; 37 of the respondents, representing 74%, show a medium level and 3 of the teachers surveyed, representing 6%, show a high level regarding the pedagogical dimension of virtual education. Regarding the second dimension, the communicative dimension, 10 teachers representing 20% have a low level; 36 of the respondents representing 72% show a medium level; while 4 of the respondents representing 8% perceive a high level. With regard to the third dimension concerning technology, 31 teachers (62%) have a medium level, while 19 respondents (38%) have a high level. Regarding the fourth dimension on organization, 28 teachers (56%) have a low level; 20 (40%) have a medium level; while only 2 (4%) have a high level.

4.2 Hypothesis Testing

Because the research is at a causal correlational level, the normality test is not necessary. For hypothesis testing, the coefficient of determination was applied to determine the influence of the independent variable on the dependent variables. To determine the percentage of influence, the Ordinal Logistic Regression (OR) test was used, considering the following criteria for decision making:

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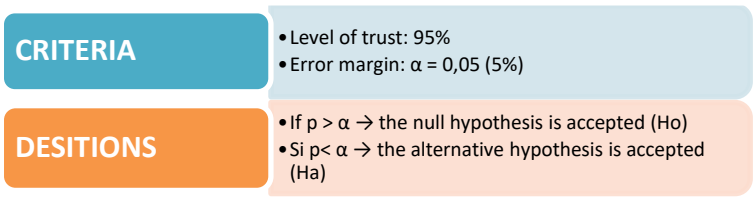

Figure 1. Decision-making criteria

General hypothesis test.

Ha: There is an influence of the pedagogical use of Smartphones on academic performance and virtual education in secondary schools in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

Ho: There is no influence of the pedagogical use of the Smartphone on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

Table 6. General hypothesis test

Information on model adjustment				
Model	-2 log de la verosimilitud	Chi-Squared	gl	Sig.
Intersection only	208,882			
Final	168,926	39,956	15	,000
Link function: Logit.				

Table 7. Level of influence of pedagogical use of Smartphone on academic performance and virtual education.

Pseudo R-Squared	
Cox y Snell	,550
Nagelkerke	,553
McFadden	,145
Link function : Logit.	

Decision: observing table 6 the sig. value = 0.000 < 0.05 therefore the null hypothesis is rejected and the alternative hypothesis is accepted; as for the level of influence the R2 Nagelkerke value established in table 7 indicates that the variable pedagogical use of the Smartphone influences 55.3% in academic performance and virtual education in secondary

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school in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

Specific hypothesis 1 test.

H1: There is influence of Smartphone Access by teachers and students on academic performance and virtual education in secondary school, in the educational institutions of the municipality of Toledo, department of Norte de Santander, Colombia, during pandemic 2020.

Ho: There is no influence of Smartphone access by teachers and students on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

Table 8. Specific hypothesis 1 test

Information on model adjustment				
Model	-2 log de la verosimilitud	Chi-Squared	gl	Sig.
Intersection only	180,587			
Final	162,264	18,323	9	,032
Link function: Logit.				

Table 9. Level of influence of Smartphone access by teachers and students on academic performance and virtual education

Pseudo R-Squared	
Cox y Snell	,307
Nagelkerke	,308
McFadden	,067
Link function : Logit.	

Decision: when observing table 8 the sig. value = 0.032 < 0.05 therefore the null hypothesis should be rejected and the alternative hypothesis accepted ; as for the level of influence the R^2 Nagelkerke value established in table 9 indicates that the dimension access to smartphone by

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teachers and students influences 30.8% in the variables academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the pandemic 2020.

Specific hypothesis test 2.

H2: There is influence of the didactic use options offered by the smartphone on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

Ho: There is no influence of the didactic use options offered by the smartphone on academic performance and virtual education in secondary school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during pandemic 2020.

Table 10. Specific hypothesis 2 test.

Information on model adjustment				
Model	-2 log de la verosimilitud	Chi-Squared	gl	Sig.
Intersection only	174,082			
Final	145,021	29,061	10	,001
Link function: Logit.				

Tabla 11. Level of influence of the didactic use options offered by the Smartphone on academic performance and virtual education.

Pseudo R-cuadrado	
Cox y Snell	,441
Nagelkerke	,443
McFadden	,106
Linking function: Logit.	

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Decision: by observing in table 10 the sig. value = 0.001 < 0.05 the null hypothesis is rejected and the alternative hypothesis is accepted; determining the level of influence based on the R2 Nagelkerke value established in table 9 that the didactic use options dimension offered by the Smartphone influences 30.8% in the variables academic performance and virtual education in secondary school, in the rural educational institutions of the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic.

4.3 Discussion

According to the results observed in the previous chapter of this research, the potential offered by the Smartphone as a pedagogical tool to improve the academic performance of elementary and middle school students in rural educational institutions can be seen. By correlating the independent variable Pedagogical use of the Smartphone with the dependent variables academic performance and virtual education, relevance is given to the conclusion that Pinos et al. (2018) proposed in their research when they called for the use of the Smartphone for educational purposes, reducing the misuse that schoolchildren make of this device, which increases its availability and accessibility in children and young people of school age, even in rural areas of the geography of the municipality of Toledo and very possibly of the national geography of Colombia DANE (2018).

When evaluating the influence that the pedagogical use of the Smartphone has on academic performance and virtual education in the midst of the pandemic in rural educational institutions of basic secondary and technical middle school in the municipality of Toledo, we can affirm with high precision that the pedagogical use of the Smartphone has a very significant influence of 55.3% on academic performance and virtual education, confirming what Rentería & Ayala (2017) express when they state that the use of mobile devices improves learning in their case of mathematics and in the present research it is additionally observed in the subjects of natural sciences, social sciences, Spanish and English, in the virtual or distance education to which most of the educational institutions worldwide were forced by occasion of the pandemic Covid-19 UNESCO (2020b).

Observing the results when evaluating the dimension access to smartphones by teachers and students, it can be observed with a high degree of certainty a significant influence of 30.8% of the same, in academic performance and virtual education in the middle of the Covid-19 pandemic; although this influence is not so high it is very positive and evidence at the same time that most probably not all teachers handle these devices properly so in many cases they do not feel very comfortable using them as pedagogical tools in their classes, as well as some students have difficulties in accessing mobile devices connected to the Internet. This finding contrasts with Mangisch, G. & Mangisch, M. (2020), when they state that the didactic use of new and increasingly widespread mobile technologies should be maximized to strengthen teaching and learning processes at all academic levels, and this is the responsibility of managers and teachers.

In the test of the specific hypothesis 2, it is evident with high precision that there is a significant influence of the didactic use options offered by the Smartphone on academic performance and

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virtual education in the midst of the 2020 pandemic, particularly in official secondary and middle school educational institutions of a rural nature. This statement is very important since it broadens towards rural areas what Arenas (2018) found in the application of his research when parents of students in an urban educational institution asked for the pedagogical and educational use of cell phones to be potentiated, since they are devices that students could use at school and at home. Analyzing these results strengthen Ortega (2019) thesis when he states that the pedagogical use of ICT tools such as computers and cell phones motivates learning in students and improves the school climate in educational institutions, thus projecting the pedagogical use of the Smartphone not only in the midst of the pandemic, On the contrary, its pedagogical use should be potentiated in all educational institutions in the post-pandemic period, since its acquisition is becoming more widespread every day and if it is not properly used in educational processes at any academic level, it can become an obstacle to achieve effective teaching and learning processes at all academic levels.

5. CONCLUSION

In the research it was determined that the influence of the pedagogical use of the Smartphone in the academic performance and virtual education in high school, in the rural educational institutions of the municipality of Toledo, department of Norte de Santander, Colombia, during the pandemic 2020 is very significant, which favors the good use of the Smartphone for educational purposes in the official educational institutions of rural character, which will result in very good results in terms of academic performance and the possibilities of virtual education in the post-pandemic period.

Likewise, it was possible to determine with very good precision the influence that access to Smartphones by teachers and students has on academic performance and virtual education in secondary schools in the educational institutions of the municipality of Toledo, department of Norte de Santander, Colombia, during pandemic 2020, which is significant according to the rural context in which the research was developed, evidencing in some way the technological gap between rural and urban educational contexts; however, even with this gap, the pedagogical use of Smartphones in rural educational contexts is possible.

Regarding the influence exerted by the didactic use options offered by the Smartphone on academic performance and virtual education in high school, in rural educational institutions in the municipality of Toledo, department of Norte de Santander, Colombia, during the 2020 pandemic, it can be concluded that such influence is quite significant since the didactic use options offered by the Smartphone are very diverse and every day are increasing in number and usefulness, which favors the possibilities of positive use of the Smartphone in the teaching-learning processes.

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5.1 Limitation

This research has presented some limitations, such as: (i) The great distances between the Educational Institutions that were focused in the research due to their rural location and difficult access due to the poor state of the land access roads. (ii) Difficulties in connectivity for some teachers who, in spite of this, look for ways to connect to continue their pedagogical work. (iii) The time in which the research was carried out due to the fact that it was framed within the academic calendar of the Educational Institutions that were targeted. (iv) It should be taken into account that in this research only the perceptions of the teachers were taken into account; the students could not be taken into account due to the restrictions caused by the health emergency caused by the Covid-19 pandemic.

5.2 Future Research Suggestion

The research could be expanded with an investigation to determine the influence of the pedagogical use of Smartphones in the physical classroom on school coexistence and the motivation to learn of students in rural and urban educational institutions from the perspectives of teachers and students; the above in order to provide real and very well contextualised information to educational institutions and the Ministry of Education to regulate the pedagogical use of Smartphones in the classroom and outside the classroom, to take advantage of all the pedagogical potential that this device offers at all educational levels.

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