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INTEGRACIÓN DE LA TECNOLOGÍA EDUCATIVA A TRAVÉS DE MÓDULOS INSTRUCCIONALES, PARA EL MEJORAMIENTO ACADÉMICO DE UN PROGRAMA DE MATEMÁTICAS. CASO DE ESTUDIO ESCUELA EVA Y PATRIA CUSTODIO (PUERTO RICO)

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Resumen. Las matemáticas son fundamentales en la formación estudiantil. El problema que enfrentan muchos estudiantes es entender la enseñanza de las matemáticas. Los educadores por años han intentado integrar la tecnología a la educación de esta materia y aumentar el aprovechamiento académico. El propósito de este estudio fue auscultar si la Integración de la Tecnología Educativa a través de Módulos Instruccionales ayudaría en el mejoramiento académico de los estudiantes del programa de matemáticas en trigonometría en la Escuela Eva y Patria Custodio de Las Marías, Puerto Rico. La investigación se centró en el método cuantitativo correlacional. La investigación se realizó en la mencionada institución, con estudiantes de undécimo grado del curso de trigonometría, durante el semestre de agosto a diciembre del 2020. Se utilizó una muestra de 95 de estudiantes matriculados en dicho curso. En esta participaron 45 estudiantes en el grupo control y 45 en el grupo experimental. Los datos se recopilaron mediante un cuestionario, pre y post prueba y cuatro exámenes. El análisis estadístico de los datos incluye: frecuencias, porcentajes, medias, análisis de varianza (ANOVA), los cuales se realizaron con el programa estadístico "SPSS" y "Microsoft Office Excel 2016". Los resultados de la investigación demostraron que sí existe diferencia significativa entre la integración de los módulos instruccionales en el curso de trigonometría y el aprovechamiento académico del estudiante. De acuerdo a los resultados obtenidos se presentaron recomendaciones para el área educativa y estudios posteriores que permitan aportar a la comunidad educativa a mejorar la enseñanza de las trigonometrías.

Palabras clave: Tecnología Educativa, Integración Tecnológica, Aprovechamiento académico, Módulos Instruccionales, Matemáticas en Trigonometría.

INTEGRATION OF EDUCATIVE TECHNOLOGY THROUGH THE INSTRUCTIONAL MODULES, FOR THE BETTERMENT OF A MATHEMATICS PROGRAM. CASE STUDY EVA AND PATRIA CUSTODIO SCHOOL (PUERTO RICO)

Abstract. Mathematics are fundamental in student training. A problem that many students face is understanding the teaching of math. For years, educators had tried to integrate technology to teachings of this subject and increase academic achievement. The purpose of this study was to perceive if the Integration of Educational Technology via Instructional Modules aided in the academic improvement of students under the math program in Trigonometry at the Eva y Patria Custodio School. The design of the study was centered in the correlational quantitative method. The investigation was performed in the mentioned institution, with students coursing the Trigonometry concentration in 11th grade, during the August to December 2019 semester. A sample of 95 students enrolled in the course was used. In it, 45 students participated in the control group and 45 in the experimental group. The data was compiled through three surveys, pre and post -tests, and four exams. The statistical analysis of the data included: frequencies, percentages, medias, variance analysis (ANOVA), which were realized with the statistic program "SPSS" and "Microsoft Office Excel 2016". The results of the investigation demonstrated that there was a significant difference between the integration of the instructional modules in the introductory mathematics course and the student's academic achievement. According to the obtained, there were recommendations presented for the academic areas and for subsequent studies that allow the educational community to improve the teaching of Trigonometry.

Keywords: Educative Technology, Technology Integration, Academic achievement, Instructional Modules, Mathematics in Trigonometry.

Introduction

The purpose of this study was to identify, compare, and determine if there is a relationship in the Integration of Educational Technology, through Instructional Modules, as a support strategy for the improvement of academic achievement in the mathematics program in the trigonometry course. In our times, mathematics is a necessity in the context of the knowledge society to face the challenge presented by social trends and decision making. It is also essential to contribute to the integral development of the human being. "Difficulties in learning mathematics are thus interpreted as failures in one of the elementary processes of information processing. For this reason, cognitive remediation teaching programs are developed to alleviate these difficulties," (Barrallores, 2016, p. 42).

According to the DEPR (2016, p.16), "successful academic and professional performance in contemporary society requires students to develop mastery of the communication skills of information use and management and the application of technology in their work." In addition, the latter can be used as a tool for deep and lifelong learning in the student. As Arroyo (2013) points out, mathematics has traditionally been a headache for educators, parents, and students. A high percentage of students feel fear and lack of interest when facing this subject.

Mathematics is a fundamental reference in the formation of any student. The problem faced by many students is to be able to understand and comprehend it. It is important to point out, as Arroyo (2013, p.2) indicates, "the purpose of basic and intermediate education should be for students to achieve the necessary competencies to understand, use, apply, and communicate mathematical concepts and procedures." Faced with this problem, educators have made several attempts over the years to achieve an effective integration of technology into the education of this subject in Puerto Rico and

thus increase academic achievement in this discipline. Therefore, "the implementation of technologies becomes a necessity, which has as a purpose to find new strategies that allow reaching the understanding of mathematical elements that surely cannot be achieved through the traditional school," (Ortiz and Romero, 2015, p. 6).

The emergence of information and communication technologies (ICT) has had an impact on the functions of the education system and allowed innovation in the transmission of new knowledge. Educational institutions, possessors, and distributors of knowledge are no longer the only sources of knowledge. ICTs are offering students access to unlimited sources of knowledge to multimedia tools that allow them to expand their knowledge of information.

The Puerto Rico Department of Education (DEPR) has kept pace with the constant social changes generated, essentially as a result of advances in areas related to information, technology, and economics. According to the Curricular Framework of the Mathematics Program (DEPR, 2016), mathematics is taught with a constructivist problem-solving approach from primary grades. This approach involves greater emphasis on the development of important mathematical concepts giving less emphasis on memorizing and doing mechanical procedures. The approach allows each student to learn to enrich, refine, and extend their knowledge through problem solving, research, and the exercise of higher level thinking skills.

Over the years, the Escuela Eva y Patria Custodio Franqui School in the town of Las Marías, Puerto Rico, has taken on the task of motivating students to become more interested in mathematics by seeking different teaching methods to improve their academic achievement. It promotes the potential and challenges of information technologies for the transformation of new academic offerings that go hand in hand with today's modern world.

The interest in studying this topic responds to the fact that currently the low level of academic achievement of students graduating from the Puerto Rico Department of Education system means that they arrive at universities with a deficiency in basic courses such as mathematics. The Department of Education has decided to overcome this problem with the new Curricular Framework and transcend this paradigm to integrate technologies as tools for student learning and academic achievement. This makes it necessary for schools and universities to create new teaching methods or at least complement them through the use and integration of technology into the mathematics curriculum.

At the Eva y Patria Custodio Franqui School, the low academic performance of students taking the mathematics course or taking the Puerto Rican tests to measure the learning achieved is not the exception either. Data collected by the researcher through the statistics of the Office of the Eva y Patria Custodio Franqui School, (2010-2020), show that during the years from 2010 to 2020 have reflected an increase in the deficiencies of students in mathematics courses.

Table 1
Breakdown of Puerto Rican Mathematics Test Results by Academic Year (2010 - 2020)

Academic year	**Advanced qualification / proficient**			**Pre-basic qualification Basic**		
	Number of students in the academic year	Number of students who passed the tests	Percent	Number of students in the academic year	Number of students who did not pass the tests	Percent

2010 – 2011	83	9	11%	83	74	89%
2011 – 2012	88	20	23%	88	68	77%
2012 – 2013	92	70	76%	92	22	24%
2013 – 2014	88	2	2%	88	86	98%
2014 – 2015	73	45	61%	73	28	39%
2015 – 2016	70	1	1%	70	69	99%
2016 – 2017	73	0	0%	73	73	100%
2017 – 2018	57	5	9%	57	52	91%
2018 – 2019	59	11	19%	59	48	81%
2019 – 2020	64	13	20%	64	51	80%

Note: Escuela Eva y Patria Custodio Office (2010-2020).

In the table it can be observed how through the years, specifically from 2016 to 2019, more than 90% of the students did not pass the Puerto Rican tests in the area of mathematics. On the other hand, it can be seen that during 2018 to 2020, 80% of the students did not pass these tests either.

Literature Review

For Avilés and Travers (2012), "the teaching of mathematics has taken a different turn during the last few years. Technology has revolutionized this subject to streamline processes and make a more user-friendly environment, so that students increase their performance in mathematics." In their book entitled "Using multiple coordinated representations to teach linear functions," they conducted a study to evaluate the achievement of first year students at the high school level. They used multiple representations of linear concepts through a technological platform. The study covered a period of four weeks of lesions based on linear functions which were developed through the "Microsoft Excel" program. Fifty-two students enrolled in algebra courses participated in the study. One test group was instructed only with their textbook. The remaining students underwent an intensive computer-based course. The results concluded that the greater the use of technology, the higher the academic achievement. For Domingo and Marqués (2011), incorporating ICTs into education not only provides more possibilities to facilitate and bring knowledge closer to more places and people, but also implies an innovation in education that leads to better trained teachers and solid educational processes. This confirms what Cabero and Llorente (2015, p.186) expressed: "Information and Communication Technologies (ICT) entail transformations and restructuring that lead to the creation and exchange of knowledge, as well as new ways of acquiring, approaching, and organizing the training process."

According to Ruiz and Dávila (2016, p. 2), "e-Learning, understood as a modality of virtual training supported by information and communication technologies (ICTs), is becoming increasingly popular in national and international university academic environments." These also point out that it is estimated that during 2015, 50% of the world's university students were enrolled in "e-Learning" courses and that every fourth university used ICT resources in their academic training. However, for Fajardo, Andino, and Fernández (2016), "there has been talk of new technologies applied to education, but little has been said about how mathematics teachers can incorporate these technologies into their teaching practice with evidence of improvements in their classroom performance." According to these, to achieve the incorporation of ICTs in the classroom will depend on the ability of teachers or educators to constitute the learning environment in such a way that it allows ICTs to be combined with new teachings and to promote dynamic classes and encourage cooperative interaction, collaborative teaching, and group work. The above is related to what Rodriguez and Hamra (2013) point out, which indicates that students of this century use technological devices, which can be: a laptop,

cell phone, compact disc, among other portable devices. In this way, they point out that the educator of the present has to break the paradigms of a traditional education based on old teaching and learning strategies, which are not very attractive for the 21st century learner.

Cruz and Puentes (2012), conducted a study that sought to know the use of different technological resources in the teaching and learning process of basic mathematics. To conduct the research study, a sample of 13% of the population taking the basic mathematics course was selected. The students were evaluated on their academic performance and skills acquired through the use of ICT tools. The results obtained showed that 91% of the students passed the course. Of these, 46% passed with high grades; however, 8% of the students failed the course. In addition, it was detected that 1% of the students in the project dropped out of the course. This was one of the lowest percentages of the semester in this subject. It was also concluded that 95% of the students were interested in continuing to use technological tools in their mathematics classes, and 5% thought that the use of these tools was a little complex.

Huckstadt and Hayes (2005), cited in Reyes (2012), conducted a qualitative method research to examine the efficiency of two interactive online learning modules and their perceptions of online learning strengths and weaknesses. The sample consisted of 73 students at the undergraduate level, ranging in age from 25 to 59 years old. The majority of students responded positively to the online learning method, including comments indicating that they enjoyed learning through this method. The study concluded that the efficiency and quality of online learning are important elements for student satisfaction. This confirms what Furioni (2015, p. 95) pointed out, "ICTs have expanded the possibilities of modifying pedagogical approaches and have managed to resize the didactic proposal in relation to the use of virtual learning communities, since the first attempts to conduct online courses began with them."

Guevara, Magaña, and Picasso (2019), conducted an investigation to find out if the use of the "Google Classroom" virtual educational platform served as a support for teachers and as an alternative for teaching their class content. In this research, 26 teachers participated from a population of 90 educators from different educational areas within their school Institution Benemérita Escuela Normal Federalizada. A questionnaire of 11 multiple-choice questions was applied to them. The research concluded that the use of "Google Classroom" could allow support to face-to-face classes, in addition to providing multiple online activities in collaborative work, thus favoring the teaching and learning process. It also concluded that not all teachers share a positive opinion related to the platform, since many of them did not know or had not used it. Therefore, the researchers suggest that a training that involves the teacher and that can develop competencies through the use of information technologies is necessary.

This is consistent with a study conducted by Fariña, González, and Área (2013), which sought to analyze at the University of La Laguna the use of virtual classrooms in the teaching and learning processes through the tools offered by Moodle. The sample used was 206 teachers. Three instruments were used to collect the information: statistical information from the Moodle platform, monitoring of the virtual courses, and administration of opinion questionnaires to the teachers of the virtual courses. The results of the analysis concluded that virtual practice is becoming increasingly important in this University where 59.3% of the resources incorporated are "PDF" documents, multimedia presentations, videos, and audio files.

Área, Hernández, and Sosa (2016) presented the results of a study, in which they analyzed the degree and type of ICT management that teachers carried out in classrooms. A computer per student, interactive whiteboard, multimedia projectors, and access to the

Internet network were used. A descriptive correlational design was used, supported by a survey study in which around 3,160 teachers from the entire region of Spain who participated in the Escuela 2.0 Program responded. The results of the study reflected that the incorporation of technological resources does not displace traditional resources but rather leads to hybrid models where technology and traditional teaching coexist. In other words, where there is abundant use of technology, the teacher tends to use it with different degrees and variants, although sympathizing with traditional teaching resources, such as textbooks or blackboards.

A study similar to the one mentioned above is the one presented by Castañeda (2017). He conducted a study whose objective was to design and implement a didactic unit for the teaching of multiplication of natural numbers through the use of ICTs in second grade students of the educational institution Cerca de Piedra in the municipality of Chía in Colombia. The research used was a mixed descriptive research with the participation of 28 students from the 202nd grade belonging to the experimental group and 28 students from the 202nd grade belonging to the control group. The research was developed in four phases: the first was the diagnostic phase, the second was the design of activities of the didactic unit, the third was the application of the didactic unit with the students of the experimental group, and the last was the evaluation and comparison phase. The implementation of a final test served as a basis for contrasting the progress of the experimental group in comparison with the control group. The didactic unit used consisted of resources such as: computer, video, television, interactive games, and the technological resources available in the classroom. The results of the study showed that 60% of the students in the experimental group developed competencies in learning multiplication, achieving the proposed objectives of the study. Among the conclusions of the study, it was found that the use of ICTs in the teaching of mathematics favors the learning of multiplication because it allows creating environments where students become the main figures of their own learning.

Cardona (2017), conducted an investigation to determine whether the solution of problems involving trigonometric functions were easier for the student when using ICT support tools. The Moodle platform was used to upload contents of said subject so that the student could have the materials at all times either face-to-face or virtually. This was done at the Antonio Ricaurte Educational Institution in the city of Medellín with tenth grade students. The sample was divided into a control group with 28 students belonging to group 10A and an experimental group with 34 belonging to group 10B. This group was selected in order to observe the progress they showed in the teaching and academic processes according to the basic learning standards. In order to obtain the results, the research was carried out quantitatively and qualitatively. A pre-test was carried out in order to know and identify the previous knowledge in the field of trigonometry and thus be able to compare the results obtained after applying the treatment. It was found that 65% of the control group had a basic mastery compared to 53% of the experimental group. Thus, it could be observed that the group where the intervention was carried out showed less strength in terms of specific knowledge related to trigonometry topics. Once the treatment was implemented in the pre-test results, it was found that there was an increase in the mastery of trigonometry skills in both the experimental and control groups. In addition, the progress was significant, which allowed inferring that there was a good work in the intervention with the teaching-learning process facilitated by Moodle platforms. The study concluded that there was a better academic performance in the students both in the cognitive part and in the development of collaborative work.

Puente (2014) conducted a qualitative-quantitative study to learn about the use of "Webquests" and their impact on the improvement of mathematics learning. The study

used a population of 84 students of the eighth grade of elementary education and 22 teachers of the school. In order to obtain the results of this research, the researcher prepared a questionnaire for each of the students considered. The instrument was a questionnaire according to the level of each one of them. According to the data obtained, 35% of the teachers surveyed taught mathematics through the notebook, 34% used the blackboard, 28% used algebra, and 3% used the "Webquest," which indicates that teachers use more traditional resources and very few use the "Webquest." On the other hand, the study revealed that there is a predisposition on the part of students and teachers to receive the necessary training on the use of Webquests for teaching and learning mathematics. A similar study was presented by Furioni (2013), which had as its purpose the creation of a Web-based course for the Analytical Geometry class of students of the Schools of Electricity and Electronics of the University Institute "Santiago Mariño," extension of Valencia, Venezuela. This research was carried out under the feasible project modality, supported by a field study and documentary research. A sample of 120 third semester students was selected. A questionnaire with 20 closed questions was used as an instrument for the collection of information. The results obtained showed that 56% of the students found that a Web-based course would be a novel didactic resource and that it would serve as a tool to facilitate the learning of the said subject. Also, 69% considered that the application of a Web-based course would help to prepare the pace of comprehension more than when in the classroom.

González and Martínez (2017), presented a study on the perception of students and professors about the presence of ICTs in universities. This study was conducted at the Universidad Distrital Francisco José de Caldas in Bogotá, Colombia. The research was a quantitative descriptive research carried out through the provision of on-line questionnaires. The sample used was 515 students. The results of the study showed that 76.8% of the interviewees perceived that the use of ICTs such as virtual courses, e-mail, Internet, digitized documents, or software are positive for their teaching. On the other hand, the research also found that 69.5% of the teaching staff is more proactive in the use of ICTs. Also in the study, it was shown that what students perceive in their learning with the use of ICTs predominates at the beginning and in the middle of their studies, while at the end of their studies the perceived impact on their learning was lower. In other words, ICT may be present in teaching, but tied to traditional teaching and with a positive but superficial impact on their learning.

García and Basilotta (2015), conducted a study which aimed to know the results of the evaluation of a learning process developed through the participation of primary school students in collaborative learning projects with ICTs in the primary school of Castilla y León in Salamanca. An evaluation scale in semantic differential format, constructed and validated by the researchers themselves, was used. It was carried out through the "ACOTIC-ALU" scale, which consisted of 20 questions adapted to the age of the students with a 7-point response scale. The sample consisted of 140 students in grades 50 and 60. The results showed that 5.75 on a scale of 1 to 7 were highly positive with the use of ICTs in learning. It concluded that four factors can be highlighted in collaborative learning: satisfaction with learning, organization of work, creation and collaboration, and understanding of the activity.

Villalda (2013), conducted a study that aimed to create a methodological tool on the use of ICTs in the classroom and to know its impact on the teaching-learning process of quadratic functions through the use of the Moodle platform. A sample of 31 students from the 9^3 grade of the Gabriel García Márquez Educational Institution in Colombia was taken as the experimental group. They used the incorporation of the teaching tool through the Moodle platform. The control group consisted of 34 students belonging to grade 9^2 of

the same institution, and they worked with the same topics of the experimental group but with the use of the traditional teaching method. The results obtained showed that the students in group 9^3, who worked with ICTs, showed a better disposition and greater interest in the subjects studied. In addition, they improved their academic achievement. It was also demonstrated that the incorporation of audiovisuals and the use of technologies in the classroom provide better active participation by the students. This agrees with Arana (2012), who conducted a research to investigate the impact of a virtual mathematics laboratory designed on the "Moodle" platform on undergraduate students of the Adventist University Corporation in a differential calculus course. The research used a quasi-experimental method in which instruments were applied to measure the impact of attitude, skills, and abilities during the beginning, course, and end of the time stipulated for the research. A sample of 46 students enrolled in differential calculus was used. The sample was divided equally into two parts, that is, 23 students in the control group and 26 in the experimental group. The study was able to establish that there was a significant difference between those who participated in the research designed through the "Moodle" platform compared to those who took face-to-face classes. In addition, it was found that, on average, among the students who participated in the Virtual Mathematics Laboratory, there was an increase of 20% more compared to the students who relied on the traditional method with texts, pencil, and paper.

Method

Design

The research focuses on a quasi-experimental design. In quasi-experimental designs, one or more independent variables are deliberately manipulated, with the purpose of observing their effect on at least one independent variable. In this type of experiment, the subjects are not selected at random but rather are pre-specified prior to the experiment. In other words, the reason for the emergence of this group was one independent of the experiment; therefore, it is considered an intact group (Hernández, Fernández & Baptista, 2014, P. 151).

The scope of this research is a correlational one, whose purpose is to know the relationship or degree of association that exists between two or more concepts, categories or variables in a particular sample or context (Hernández et al. (2014, p.93). According to this design, two groups will be used, one control and the other experimental.

G_1	O_1	X	O_2
G_2	O_3	-	O_4

Figure 1. Experimental Design

Note: Taken from Author Hernández, Fernández and Baptista (2014).
Legend: G_1: Experimental group; G_2: Control group; X: Treatment; O_1 and O_2: Pre-test; O_2 and O_4: Pre-test.

Participants

The population used in the research study was centered on eleventh grade students who took the mathematics course specifically trigonometry at the Escuela Eva y Patria Custodio located in Las Marías, Puerto Rico. Four sections of the mathematics course specifically trigonometry were offered at this school, with an enrollment of 95 students. The trigonometry courses were divided as follows; grade 11-1 with 25 students, 11-2 with 23 students, 11-3 with 24 students, and 11-4 with 23 students. All four sections participated in the study. The sample was divided into a control group composed of grades 11-1 and 11-3 and an experimental group composed of grades 11-2 and 11-4, each group was composed of a total of 45 students using a final sample of 90 students from which to obtain the final number four were randomly drawn from the control group and one from the experimental group. For the research, the control group was instructed in a traditional way, while the experimental group used the instructional modules, through the "Google Classroom" platform, as a support tool for academic improvement.

Instruments

As instruments for data collection, a quantitative design questionnaire was administered to answer the research questions and hypotheses, the administration of a pre-test and post-test and the evaluation of the comparative results of four exams in order to measure quantitatively whether there were significant differences between the tests. The questionnaire was applied only to the experimental group and was used to know the level of satisfaction and experience in the course through the digitalized instructional modules. It consisted of fourteen (14) items. These items were answered using the Likert Scale with five degrees of gradation: (5) Very Satisfied, (4) Satisfied, (3) Neutral, (2) Dissatisfied, (1) Very Dissatisfied. The questionnaire was accompanied by informed consent for participants regarding confidentiality protection.

Data analysis

The data for this research were collected by the researcher. The instructor of the mathematics course in trigonometry was responsible for administering the pre-test, post-test, and the four exams. The instructor provided the researcher with the results of the pre-test and post-test, as well as the results of the four exams. Descriptive analyses such as average, frequencies, percentages, means, analysis of variance (ANOVA), and standard deviation were performed on both. For the comparison of the groups, a simple paired data T-test was used between the control and experimental groups, with an a priori significance level ($p < 0.05$). The data obtained during the investigation were processed using the program "Statistical Package for the Social Sciences" and "Microsoft Office Excel 2016."

Results

Based on the results obtained from the data analysis of this study, the answers to the three research questions and the three hypotheses established are presented.

1. *What is the level of skill mastery of the students of the Eva y Patria Custodio Franqui School who use the integration of educational technology through instructional modules*?

H1: The greater the integration of educational technology through instructional modules, the greater the mastery of skills of the students of the Eva y Patria Custodio Franqui School in the Trigonometry mathematics course.

H0: The greater the integration of educational technology through instructional modules, the lower the mastery of skills of the students of the Eva y Patria Custodio Franqui School in the Trigonometry mathematics course.

A pre- and post-test was conducted to determine the students' level of mastery in using technology integration where they reflected the following results.

Table 2
Comparative statistics between Pre and Post Test

Group statistics

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Pre-test	Control Group	45	7.04	2.121	.316
	Experimental Group	45	7.00	2.477	.369
Post-test	Control Group	45	18.07	2.903	.433
	Experimental Group	45	22.62	3.193	.476

Table 2 shows that when the pre-test was applied, the control group obtained an arithmetic mean of 7.04, while the experimental group obtained 7.00, with a difference of .04 in favor of the control group. Once the post-test was administered, the results indicated that the control group obtained an arithmetic mean of 18.07, and the experimental group obtained 22.62, with a difference of 4.55 in favor of the experimental group.

Table 3
Independent samples test - pre-test and post-test - control and experimental groups

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pre Test	Equal variances assumed	1.035	.312	.091	8 8	.927	.044	.486	-.922	1.011

	Equal variances not assumed			.091	85.960	.927	.044	.486	-.922	1.011
Post Test	Equal variances assumed	.755	.387	· 7.082	8	.000	-4.556	.643	-5.834	-3.277
	Equal variances not assumed			· 7.082	87.214	.000	-4.556	.643	-5.834	-3.277

Table 3, independent samples test, shows that the significance results in the pretest with assumed equal variances was .927 and .927 without assumed equal variances. Both values are greater than $p < .05$, so there was no significant difference. Once the treatment was applied, the post test results were .000 with assumed equal variances and .000 without assumed equal variances. Both values are less than $p < .05$; therefore, hypothesis H1 is accepted, which indicates that, the greater the integration of educational technology through instructional modules, the greater the mastery of students' skills in the trigonometry mathematics course.

2. *Is there learning in students using the integration of educational technology through instructional modules*?

H1: There is learning in students using educational technology integration through instructional modules.

H0: There is no learning in students using educational technology integration through instructional modules.

To determine if there is learning in students who used the integration of educational technology through instructional modules, the scores of the four tests provided between the control and experimental group were used.

Table 4
Comparison of the four tests of the control and experimental group

Group statistics					
	Groups	N	Mean	Std. Deviation	Std. Error Mean
Score 1	Control Group	45	79.22	20.253	3.019
	Experimental Group	45	88.31	15.864	2.365
Score 2	Control Group	45	70.49	18.377	2.739
	Experimental Group	45	83.82	15.618	2.328
Score 3	Control Group	45	67.27	19.958	2.975
	Experimental Group	45	82.67	15.110	2.252

Score 4	Control Group	45	69.51	16.384	2.442
	Experimental Group	45	84.89	12.846	1.915

Table 4 shows the comparison between the four tests given between the control and experimental groups. In the first exam there was a difference in the arithmetic mean of 9.09 in favor of the experimental group. In the second exam the difference was 13.33, in the third 15.40, and in the fourth 15.38, all in favor of the experimental group. The final result showed that the control group obtained an arithmetic mean of 71.76, while the experimental group obtained 85.09. This implies that there was a difference of 13.13 on average in favor of the experimental group in their learning through the use of the integration of educational technology by means of instructional modules.

Table 5
Independent samples test of the four tests

Independent samples										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average Final Score	Equal variances assumed	1.693	.197	-4.998	88	.000	-13.333	2.668	-18.635	-8.031
	Equal variances not assumed			-4.998	84.560	.000	-13.333	2.668	-18.638	-8.028

Table 5, independent samples test, shows that the significance results among the four exams are .000 with equal variances assumed and .000 without equal variances assumed. Both values are less than $p < 0.05$, so there is a significant difference between the results of the four tests; therefore, the hypothesis H1 is accepted, which indicates that there is learning in students who use the integration of educational technology through instructional modules.

3. *What is the level of satisfaction of students using the digitized instructional modules*?

H1: The use of digitized instructional modules is positively related to the level of satisfaction of the students who use them.

H0: The use of digitized instructional modules is negatively related to the level of satisfaction of students who use them.

The Likert Scale was used to determine whether the use of the instructional modules is positively related to the level of satisfaction of the students who used the instructional modules presented below.

Table 6
Satisfaction Scale in the use of the instructional modules

Satisfaction Scale					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	30	66.7	66.7	66.7
	Satisfied	13	28.9	28.9	95.6
	Neutral	2	4.4	4.4	100.0
	Total	45	100.0	100.0	

Table 6 of the satisfaction scale reflected that 67% of the students found the use of instructional modules to be positively related to the level of satisfaction, while 29% were satisfied and 4% remained neutral.

Table 7
Test of a sample of satisfaction level

Testing of a sample						
	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Level of Satisfaction	16.057	44	.000	1.378	1.20	1.55

Table 7 shows a simple sample test to determine whether the use of the digitized instructional modules is positively or negatively related to the level of satisfaction of the students who use them. In this one it is observed that the significance results are 0.00. This represents that the value obtained is less than $p < 0.05$, so H1 is accepted where it is confirmed that the use of the digitized instructional modules is positively related to the level of satisfaction of the students who use them.

Discussion and conclusions

Based on the research analysis, the following conclusions are presented:

- With the results obtained in the research measured by means of a pre- and post-test and the results of four exams, the null hypothesis is rejected; allowing to sustain that the integration of technology through instructional modules increases the academic achievement of students in the mathematics course in trigonometry.
- It can be supported that after the use of technology through digitized instructional modules, academic achievement among students tends to increase, since there is a significant difference between the results found between the control group and the experimental group.

- The use of instructional modules can capture the attention of students more easily and engage them in topics that are often not possible with traditional media.
- It was observed that the students showed a great degree of satisfaction when incorporating the instructional modules as a learning tool.
- The study also showed that the integration of instructional modules in the mathematics course is an innovative teaching practice for students, that it is an alternative way of learning the subject matter, and that it is a more interesting learning process.
- The study also showed that students can incorporate into their teaching methods other educational technology tools such as: mathematics computer programs, video in mathematics, tutorials available on the Internet, and the use of digitized instructional modules.
- The incorporation of technologies becomes a necessity for the teaching system, which has as its primary objective to find new strategies that allow to reach an understanding of the fundamental elements of mathematics that have been shown that traditional methods do not achieve.

Limitations of the study

- Shortage of literature on the subject studied, especially on digitized instructional modules.
- Lack of instruments that specifically measure the subject of the study, essentially when searching for a suitable scale to measure the effectiveness of the instructional modules.
- The lack of other studies related to the subject in Puerto Rico.
- The study considered only eleventh grade students in the trigonometry course.
- The results only apply to the Eva y Patria Custodio School where the study was conducted.

Continuity Proposal

According to the findings obtained when analyzing the research questions and hypotheses, it is necessary to explore different alternatives to improve the academic performance of students. Therefore, it is recommended:

- To extend the research to public schools in Puerto Rico with the purpose of identifying whether educational technologies used in instructional modules would help academic improvement.
- Conduct similar research and use as a resource the research instrument developed by the researcher for this study, for the purpose of identifying other aspects related to educational technology that positively or negatively affect students.
- Make a comparative analysis of all private schools and then compare with all public schools to determine in which of them there is a better academic performance when using instructional modules.
- Conduct future research in public schools to evaluate the training of each teacher in the use of technology.
- The results of this research can be used to explore the use of new teaching techniques by integrating technology into other mathematics courses.

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