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UNIVERSIDAD DE PUERTO RICO  
RECINTO DE RÍO PIEDRAS

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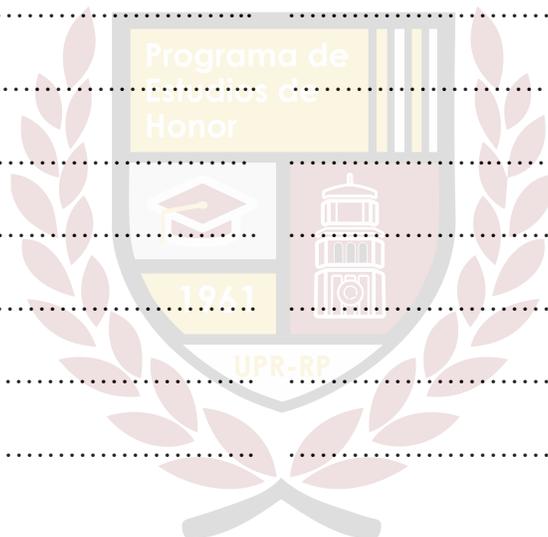
FACTORS THAT FACILITATE OR LIMIT THE USE OF TECHNOLOGY OF SECONDARY  
SCHOOL TEACHERS



DECEMBER 2018

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## Glossary

1. ICT – "Information and Communication Technologies." ICT refers to technologies that provide access to information through telecommunications such as the Internet, wireless networks, cell phones, and other communication mediums.
2. IWB – Interactive white board

## Abstract

The use of technology in the classroom has become an ever growing tendency in countries across the world. School directors and administrators have been pushing to implement its use in their schools. From mobile devices to interactive whiteboards, technological devices have become a prevalent object in the classroom. However, while students are quick to adapt to its implementation, teachers have been found to be at odds (Clarke & Zagarell, 2012). This research aimed to find out which factors facilitate or limit the use of technology in the classrooms. According to the literature reviewed the main factors that facilitate or limit the use of technology are: years in profession, availability of resources, technical support, training, funds, and the subject they teach (Armstrong, 2014; Lim, Zhao, Tondeur, Chai, Tsai, 2013). This study consisted of a comparison of two secondary level high schools, their teachers' practices, and the factors that promote or discourage the use of technology in the classroom. The two schools chosen were a laboratory school and a specialized school in math and science. A questionnaire provided to teachers covered questions about the factors. Out of the twenty teachers who participated, the study found that lack of training and or support do not have a noticeable impact on ICT use in the classroom. Additionally, subject matter was found to be a factor in lack of implementation due to the inability of teachers to adjust ICT use to the subject they teach. Also, the amount of years in the profession does not have a visible impact on ICT use, since there was

an equal amount of use across various ranges. Lastly, while an 80% of teachers agreed that the school administration promotes the use of technology, 65% acknowledged a lack of necessary support to use ICT.

## **CHAPTER I**

### **Introduction**

Technology has become a growing force in today's society, including in the classroom. From the use of tablets, smartphones, computers and even smartboards; the use of technology in the classroom has become prevalent. As stated by Al-Emran (2015), the use of smartphones and small handheld devices allows students and teachers to be able to perform daily tasks in a shorter time period. Students are now able to do any given assignment in half of the time that was previously necessary. They are able to access a wide range of information in seconds. Their immediate access to internet resources and ability to retrieve information faster has been enabled through the use of mobile technology (Domingo & Gargante, 2015). While there have been multiple studies on how technology affects a student's learning, there is another part that is affected as well. Teachers have had to learn how to incorporate it in their lesson plans, learn how to utilize the given technology, and continuously adapt to an ever-changing classroom. However, adapting to this new normalcy has not been easy. The introduction of technology in the classroom has not happened without resistance and skepticism. Teachers need to be convinced or motivated to implement the use of technology in the classroom by the school administration (Uluyol & Sahin, 2016).

Technology almost has limitless uses in and outside of the classroom. It can cover a wide range of tools inside any classroom. Information and Communications Technology (ICT) includes “computers, the Internet, and electronic delivery systems such as radios, televisions and projectors among others...” (Fu, 2013). The use of ICT provides many positive improvements to any classroom. For example, Fu states,

“Online course materials, for example, can be accessible 24 hours a day, seven days a week. Teleconferencing classrooms allow both learner and teacher to interact simultaneously with ease and convenience...Multiple resources are abundant on the Internet, and knowledge can be acquired through video clips, audio sounds, visual presentation and so on.” (p. 112)

The definition of ICT in the classroom goes beyond the desktop computer. The role touch technology plays in the classroom, such as iPads are bringing new opportunities of teaching where there were not used to be. For example, the use of educational apps at a free or low cost that can meet the student’s needs or preferences (Sehnałova, 2014). Many classrooms are also making the shift to the use of interactive whiteboards (IWBs). While they are expensive, the system includes an interactive whiteboard, computer, projector, and white boarding software (Armstrong, 2014). The use of the interactive whiteboards has had favorable benefits in the classroom, such as encouraging student motivation and participation, which in turn has motivated teachers to use them during 75% of class time (Armstrong, 2014).

Educators’ use of technology in the classroom varies according to various factors. These factors include: years in the profession, availability of resources, funding, technical support, training, and subject matter (Armstrong, 2014; Lim, Zhao, Tondeur, Chai, Tsai, 2013). Ertmer (1999) classified these factors as extrinsic and intrinsic. The extrinsic factors include a lack of

resources, lack of time and inadequate training, and insufficient technical support. On the other hand, intrinsic factors include teachers' beliefs, attitudes and views about learning and teaching (Uluyol & Sahin, 2016). When it comes to age, the 2013 survey by the Pew Research Center found that, "there are notable differences in how teachers experience the impact of digital technologies in their professional lives" (Armstrong, 2014, p.40). Yet in terms of the use of technology, the older and younger teachers have shown to be at odds (Teo, et al., 2014). However, the lack of resources and funding have demonstrated to be a huge barrier when it comes to the use of technology. While in some cases, there is opposition to the use of technology in schools, "The resistance teachers have is a response to shortcomings with the education system's implementation and their requirement. While they are willing to use ICT in their classrooms and implement it in their lessons, they are not fully prepared for what it fully entails" (Clarke & Zagarell, 2012).

Furthermore, one of the biggest obstacles to more use of technology in the classroom is the lack of preparation or training provided to teachers. Clarke & Zagarell (2012) also adds that teachers require comprehensive training to be able to successfully utilize technology and understand it well. If they are not able to access the required training, most teachers will not use the technology and continue using the same methods of teaching they always have (Clarke & Zagarell, 2012). The lack of training causes a decrease in teacher motivation and in turn, causes a decrease in technology usage in the classroom. The last remaining factor is the resistance teachers' face when it comes to integrating technology into their teaching. Part of this resistance stems from teachers viewing technology integration in parts, rather than as a whole. Technology integration is perceived as the application of hardware and software devices during their lessons, rather than as an integral part of the teaching process (Okojie, Olinzock, & Okojie-Boulder,

2006) Therefore, the attitudes of teachers towards the use of technology in the classroom is important to how and how much it is actually used. The main purpose of this research is to find out what factors play a role in teachers' use of the technology and what barriers they may face.

### Research Questions

This research aimed to answer various questions towards about the relationship between several factors and the use of technology in the classroom.

1. What is the level of usage of technology of teachers in two high schools?
2. What is the relationship between the level usage of technology in the classroom and the subject matter they teach?
3. Which factors promote the use of technology?
4. Which factors discourage the use of technology?
5. What is the relationship between the level of usage and extrinsic factors such as: years teaching, availability of resources, technical support, training, and funding?
6. Had they been trained or prepared to use it? If so, how much time did they invest in receiving training?
7. Was the training they received supported by the school or institution?

## CHAPTER II

### Literature Review

The lack of training and preparation teachers' receive to implement technology is one of the most common barriers (Lim, Zhao, Tondeur, Chai, & Tsai, 2013). To be able to have a meaningful and successful integration of technology, teachers need to be provided with the resources and training necessary (Barbour, Grzebyk, & Grant, 2017). Apart from the physical resources needed, teachers require an extensive amount of time to test out the resources, experiment with programs and apps, and create materials for their classes (Barbour, Grzebyk, & Grant, 2017). However, the teachers who consider themselves "tech-savvy" actually have superficial knowledge of technology usage; having only used social media or word-processing (Clarke & Zagarell, 2012). This causes a problem when it comes time to utilize technology in the classroom since they are unable to diversify its usage to meet their educational needs. Additionally, teachers and administrators who felt capable utilizing ICT reported being unable to integrate technology successfully due to a lack of guidelines to assist in this process (Lim, Zhao, Tondeur, Chai, & Tsai, 2013). In other words, without the extensive training and the support necessary for technology implementation, teachers will be trapped using the same methods of teaching they always have (Clarke & Zagarell, 2012).

School systems and administrations are pushing to implement technology in the classrooms at a high rate. Although there is a perception that teachers are resistant to the implementation of ICT in their classroom, it is not an ideological opposition (Clarke & Zagarell, 2012). The resistance itself stems from the deficiencies of the school's administration to implement it (Clarke & Zagarell, 2012). Obstacles faced due to the administration and ICT infrastructures include: focus on student test scores rather than ICT usage, lack of appropriate

administrative support for the use of ICT, lack of materials and hardware, mandates from the administration to focus on improving test scores, and lack of course content (Fu, 2013). It is not only teachers who need to be prepared to integrate technology, but also school administrators. To be able to motivate teachers to want to use the technology in their classrooms, administrators need to believe in the valuable component they are pushing on teachers (Uluyol & Sahin, 2016). Principals and school administrators should be just as prepared as teachers to be able to help each other out and foster a support system amongst themselves (International Society for Technology in Education (ISTE), 2009). Schools themselves are under considerable pressure to use technology in their classrooms. Since the money used for these technological resources are mainly from tax payers', policymakers have to ensure there are returns on these investments (Fu, 2013).

IWBs are an example of a growing market that has grown roots in many countries. In 2007, 98% of high schools and 100% of primary schools in England used IWBs (Lai, 2010). Other countries such as Australia, United States, and South Africa also have heavily invested projects to implement technology integration in education (Lai, 2010). If teachers who have had a small introduction to technology usage are having trouble utilizing it in the classroom, imagine teachers who have never had any preparation. In a study by the Turkish Education Association (2009), it was found that 22% of teachers never use instructional technologies in their classroom, and 49% use them only a few times a month. (Ersoy, 2015). In another study by the Ministry of National Education, in a survey of 57, 358 participants, 43% of teachers needed training in utilizing instructional technologies and creating materials (Ersoy, 2015). The need for not only training, but continuous support for teachers when implementing technology is essential to ensuring full usage. This is especially important when considering how much money is invested

into these technologies. For example, IWBs such as the SMART board, have received criticism from Kathleen Manzo for *Education Week* (2009), for being “fancy, expensive chalkboards.” The reason being that teachers do not have the training necessary to know how to properly utilize the interactive features or they simply ignore them (Armstrong, 2014).

While some of these factors are out of educators hands, their attitudes towards the implementation of technology are at odds. In a research conducted at Marymount University in Virginia, it was found that overall, teachers had a positive outlook towards the use of technology in the classroom. Knott (2013) states that over 73% of teachers view technology as extremely important in their teaching, and 86% allow technological devices to be used in the classroom. Of these 108 participants, only 10% of the teachers felt that the use of technology was not as important in the learning process (Knott, Steube, & Yang, 2013). Marzano states that technical training is essential to a successful implementation since not a majority of teachers feel confident in their ability to teach and collaborate with the students interactively (Armstrong, 2014). If these teachers do not receive the training required to keep them up to date with technological advances, their feelings of intimidation will resurface (Clarke & Zagarell, 2012). Not only do they feel intimidated, but they feel also feel anxious about having to use ICT in their classrooms with their limitations on how to incorporate or utilize it (Balanskat, Blamire, & Kefala, 2006).

Furthermore, age is an equally important factor that plays a role in teachers’ use of technology. A college level study realized found that the average age of professors is 61.6, associate professors is 57.6, and assistant professors is 57.4 (American Association of Colleges of Nursing, 2015). While the generational difference is not major, the understanding of how to properly utilize technology can cause possible conflicts. The faculty consists of mostly the boomer generation which can cause conflicts in the classroom since their students are millennials

and Generation Z are used to rapidly changing technology (Shatto & Erwin, 2017). Moreover, in a study by Teo, et al. (2014), it was found that 63% of pre-service (trainees enrolled at teacher education programs in universities or schools) had less technology experience. However, the less technology experience is due to their younger age, compared to older teachers who have more experience. Age is found to have a bigger influence on the integration of ICT among the pre-service teachers in the study. This result is consistent with the research that shows younger users of technology tend to react more positively than their older colleagues (Teo, et al., 2014).

Another study focused on the teachers' perceptions of mobile phones in the classroom and found that their age actually matters. For example, teachers in both age groups from thirty-two years old or younger and thirty-three to forty-nine, supported the use of mobile phones in their classrooms. On the other hand, the teachers fifty and older were much less supportive in all four questions studied about the use of mobile phones. They perceived barriers such as: disruptions, cheating, cyberbullying, sexting, access to inappropriate information, and a negative impact on student writing to be more problematic than their younger colleagues (O'Bannon & Thomas, 2014).

In turn the use of technology, the teacher's beliefs are what provides their motivation to apply it (Angeli & Valanides, 2009). Looi (2014) identified three factors that influence any teachers' decision making and problem solving. Their knowledge, goals, and beliefs (KGB) influence each other in these processes. A teacher's belief stems from their views about the nature of knowledge and how it is learned. Their goals are what they want to attain and achieve in their class. Lastly, their knowledge "includes content knowledge, pedagogical content knowledge and knowledge of the students" (Looi, 2014, p.2). When the three factors coincide, it means the "teacher's selection of knowledge that is based on goals which are prioritized by his or

her beliefs” (Looi, 2014, p.3). For the research, Looi collaborated with an English high school teacher, head of the English Department in his school, who had to implement a program called “GroupScribbles” into his lesson plans. Students were equipped their own personal MacBook, wireless connection throughout the whole school, and a technical staff to help teachers with the implementation of technology. The research was analyzed and divided into four developmental states, which trace the initiation, implementation, and maturation of the stages of technology implementation by the teacher. The results presented showed that there was a stagnation between the initiation and implementation because teachers become discouraged from shifting their KGBs again to have a higher level of technology usage. This could be due to the fear and or hesitancy by the teachers to change their KGBs to actually implement technology in their classrooms. While transitions can be caused by external factors such as poor test results, or intrinsic factors such as teaching misconceptions; the need for constant support for teachers in their journey to successful technology usage is a necessity.

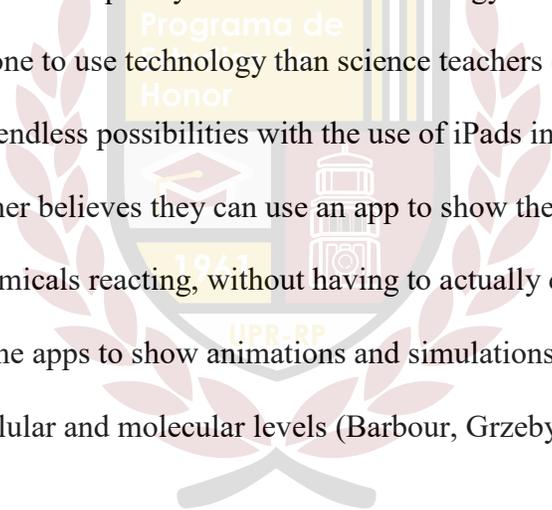
While the training teachers receive is an important factor in successfully implementing technology in the classroom, it does not matter if teachers do not even have access to these technological resources in their classroom. In a study conducted by Barbour (2017), teachers who were to integrate the use of iPads into their curriculum pointed out the lack of resources such as, the lack of internet access as a drawback. Without Wi-Fi, teachers find themselves limited since they cannot access more apps or use internet interactive apps for their classes. However, schools have found themselves needing to make sure the internet access is controlled to avoid cyberbullying, sexting, and Internet pornography (Kilfoye, 2013). The misuses of the technology such as hacking, computer viruses and cyber bullying have caused schools to be overly cautious and block various forms of online activities (Fu, 2013). Although some districts

do not have the resources to give out tablets to each student, they are implementing “rent-to-own” programs. This signifies that students can pay rental fees to be able to buy the tablet, just as they would do if it were for a book (Armstrong, 2014).

The amount of funding and budgets directed towards technology implementation are another vital factor to its successfulness. In the United States, school districts are investing large amounts of their annual budgets to integrating technology in the classroom with the hope of improving learning outcomes (Sumedha, 2016). Even though interactive boards can run as much as \$5,000 per classroom, teachers and schools are open to investing in this technology (Armstrong, 2014). On the other hand, 30% teachers who state that their schools encourage the use of technology, do not have the necessary funds or infrastructure for it to be a possibility (Waight, 2013). These same teachers state that while they are encouraged to utilize technology, they have no money to do so and many times are forced to be responsible for making it happen (Waight, 2013). Additionally, 78% of rural school districts reported that they were inadequately funded in a 2009 report by the National Association of School Administrators (Waight, 2013). Even with a lack of funding, teachers are committed to implementing technology in their daily lesson plans. For example, although teachers do use online resources, 60% of their time is divided on searching for free resources or using the ones they had to pay for out of their own pockets (Sundeen & Sundeen, 2013). In Uluyol’s (2016) research, it was found that teachers had to become self-sufficient and use their own resources or look for information on the internet to be able to support themselves.

These factors have just as much of an impact on the usage of technology in the classroom as the subject it is used in does. Cress (2013) decided to take matters into her own hand, and see how she could incorporate technology into her art class. Realizing that her students are tech-

savvy and could enjoy combining technology and art, she created the Artist Postcard project. Students created postcards that incorporated details from their lives and shared them online with another class. Another study focused on writing teachers and how they could incorporate technology into their lesson plans. Although skeptical at first, teachers were able to understand from their own experiences that using technology to teach writing is possible and promotes creativity and interactivity (Groves, 2012). Even students have expressed a confident effect of utilizing technological devices in the classroom, stating it aided them in learning math and science (Armstrong, 2014). In a study in Puerto Rico, it was found that there was a relationship between subject matter and the frequency in which the technology is used. The teachers who taught math were more prone to use technology than science teachers (De Jesús, 2005). Furthermore, teachers see endless possibilities with the use of iPads in their classrooms. For example, a chemistry teacher believes they can use an app to show their students chemistry experiments that show chemicals reacting, without having to actually do the experiment. Another teacher said he could use the apps to show animations and simulations to help his students understand concepts of cellular and molecular levels (Barbour, Grzebyk, & Grant, 2017)



## CHAPTER III

### Methodology

The purpose of this study was to find out what factors limit or facilitate the use of technology in the classroom. To be able to complete the study, two high schools with access to technological resources on their campus were chosen. The first school that took part in the study was University High School (UHS) in Río Piedras and University Gardens High School in San Juan. University High School is a laboratory school and University Gardens High School is a specialized school in Math and Science. These schools are known for their training of future teachers and educational research. The first permission needed to complete the study was from the Department of Education, Division of Pedagogical Investigations. An application was submitted along with the questionnaire to be used, the consent forms, and the proposal for the investigation. After the approval was obtained from the Department of Education to conduct the investigation, the next approval came from the Institutional Review Board (CIPSHI) at the University of Puerto Rico, Río Piedras Campus. An investigation proposal, the questionnaire, and the consent forms were submitted for review. Once CIPSHI approved the protocol for the investigation (#1718; Appendix A), the last step was meeting with the directors of the two schools to obtain access to the teachers' emails in their school. While the Department of Education gave the necessary permission to conduct the investigation, University High School does not require permission from the Department of Education. Therefore, permission to conduct the investigation in both schools was obtained directly in each school. At University Gardens High School, the Director allowed access to be able to email the teachers at the school. Next, the necessary paperwork at UHS was submitted to be given permission to conduct the investigation. The school director, and the dean of the UPR Education Department approved the investigation which allowed for the teachers' emails to be provided.

Once the necessary permissions were obtained, an email including the consent form and a link to the questionnaire on a Google Form was sent to all the teachers in both schools. The teachers who participated in the study varied in demographics, with no specific preference. All questionnaires were confidential and were unable to be identified.

The questionnaire *Factors that Facilitate or Limit the Use of Technology in the Classroom* (Appendix B) was adapted from *Cuestionario sobre Preocupaciones de los Docentes* (Pacheco, 2009). The original questionnaire evaluated teachers' configuration process, worries about the process of implementation, and the level of adoption of an innovative tool in their classrooms. Previous authorization from the questionnaire's author was obtained (Appendix C). For the purpose of this study, specific questions regarding the concerns of the teachers were used. The final questionnaire consisted of four parts. The first part was based on demographics such as: age, years they had been teaching, and what subject they teach. The second to the fourth parts focused on the specific factors that can influence a teacher's use of technology in the classroom. The statements were to be answered in four categories: strongly agree, agree, disagree, and strongly disagree. The purpose of this questionnaire was to find out how teachers view technology, and if there were certain factors that played a role in their decision to utilize it in the classroom. The technological devices that were studied included: laptops/desktops, cellphones, tablets, interactive whiteboards, and projectors. A quantitative analysis was used to be able to gather a large amount of data.

## CHAPTER IV

### Results

#### Socio-demographic Characteristics of Participants

The questionnaire included sociodemographic questions to better describe the participants. Data shows that the total sample consisted of twenty teachers who participated in the study. As Table 1 presents, out of the twenty teachers, 50% were male and 50% were female. The study had an equal amount of male and female participants. The mean age for the participants was 44 years old (Table 2). The ages of the participants ranged from 28 years old to 60 years old. The mean years in the profession was 16 years. The years in the profession ranged from 2 years to 37 years.

Table 1. *Distribution of Participants by Sex*

Sex	<i>n</i>	%
Woman	10	50.00
Man	10	50.00

Table 2. *Teachers' Mean Age and Years in the Profession*

Variable	<i>M</i>	<i>SD</i>	<i>n</i>
Age	44.47	9.84	19
Years in Profession	16.95	10.07	19

Table 3 shows the percentages of subject matter for the teachers. It was found that the prevalent subject taught by the participants is English with 25% of the teachers. The second prevalent subject is Mathematics with 20% being math teachers. With the same percentage of responses (15%), Spanish and Science teachers were the third dominant.

Table 3. *Teachers' Subject Matter*

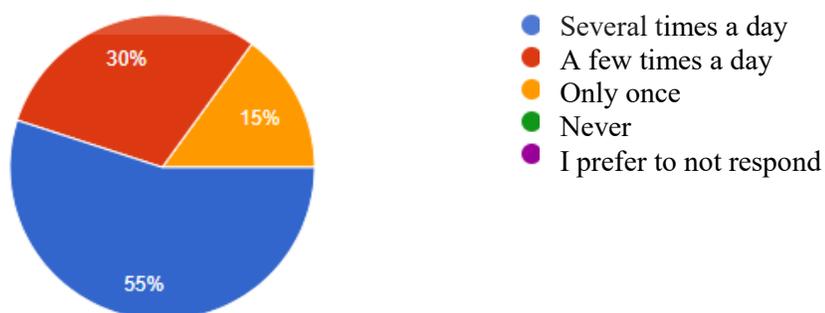
Subject	<i>n</i>	%
Social worker	1	5.00
Special education	1	5.00
English	5	25.00
Social studies	2	10.00
Mathematics	4	20.00
Spanish	3	15.00
Science	3	15.00
Family and consumer science	1	5.00

The first research question of the study was to measure the use of technology frequency of secondary teachers in Puerto Rico. As shown in Figure 1, it was found that 55% of the participants in the study utilize ICT in their classrooms various times a day, followed by 30% that utilize technology sometimes during the day, and 15% utilize it one time a day. None of the participants answered that they never use technology in their classroom.

Figure 1. *Use of Technology Frequency*

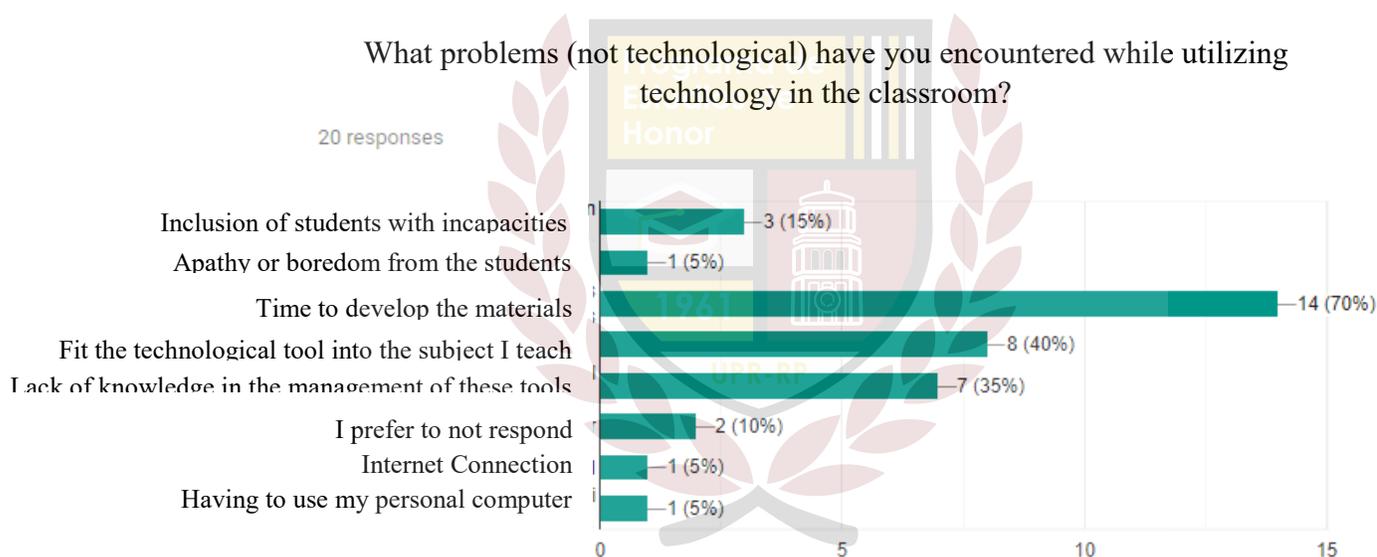
How frequently do you use ICT in your classroom on a daily basis?

20 responses



The next research question was to identify the relationship between the level of usage of technology in the classroom and the subject matter they teach. As shown in Figure 2, the majority (70%) of participants selected that their biggest problem (not technological) was the time to be able to create the materials. The second highest choice (40%) the teachers considered a problem was the lack of knowledge to implement the technological tool into their subject matter lesson plans. The third highest choice with 35% of the responses was lack of knowledge in the management of these tools.

Figure 2. *Non-technological Problems Encountered in the Classroom*



The third research question of this study was to find which factors promote or discourage the use of technology. The first factor studied was the availability of resources. In Table 4, 50% of the participants agreed or strongly agreed that they had been given the necessary ICT resources in their classrooms. The other 50% of the participants disagreed or strongly disagreed that they had the ICT resources in their classroom.

Table 4. *Availability of Resources and Funding*

Variable	<i>n</i>	%
I have been given the necessary ICT resources in the classroom.		
Strongly Agree	2	10.00
Agree	8	40.00
Disagree	6	30.00
Strongly Disagree	4	20.00

Continuing with availability of resources as the factor to be observed, in Table 5, the majority of the participants (55%) stated that they agree or strongly agree that they do not have the resources in their classroom to use ICT.

Table 5. *Lack of resources*

Variable	<i>n</i>	%
I do not have the resources in my classroom to use ICT.		
Strongly Agree	1	5.00
Agree	10.00	50.00
Disagree	7.00	35.00
Strongly Disagree	2.00	10.00

The second factor studied included the training teachers receive or have received. As can be seen in Table 6, 65% of the participants responded that they disagree or strongly disagree with the statement: “I have been provided the necessary training to integrate technology in the classroom.”

Table 6. *Training for the use of ICT*

Variable	<i>n</i>	%
I have been provided the necessary training to integrate technology in the classroom.		
Strongly Agree	1.00	5.00
Agree	6.00	30.00
Disagree	6.00	30.00
Strongly Disagree	7.00	35.00

Secondly, 50% of the participants stated that the training they received throughout their trajectory as a teacher is insufficient (Figure 3). In contrast, 40% of the participants responded that their training had been sufficient, and 5% responded their training has been optimal.

Figure 3. *Training during Professional Career*

The training you have received throughout your trajectory as a teacher to use ICT is:

20 responses

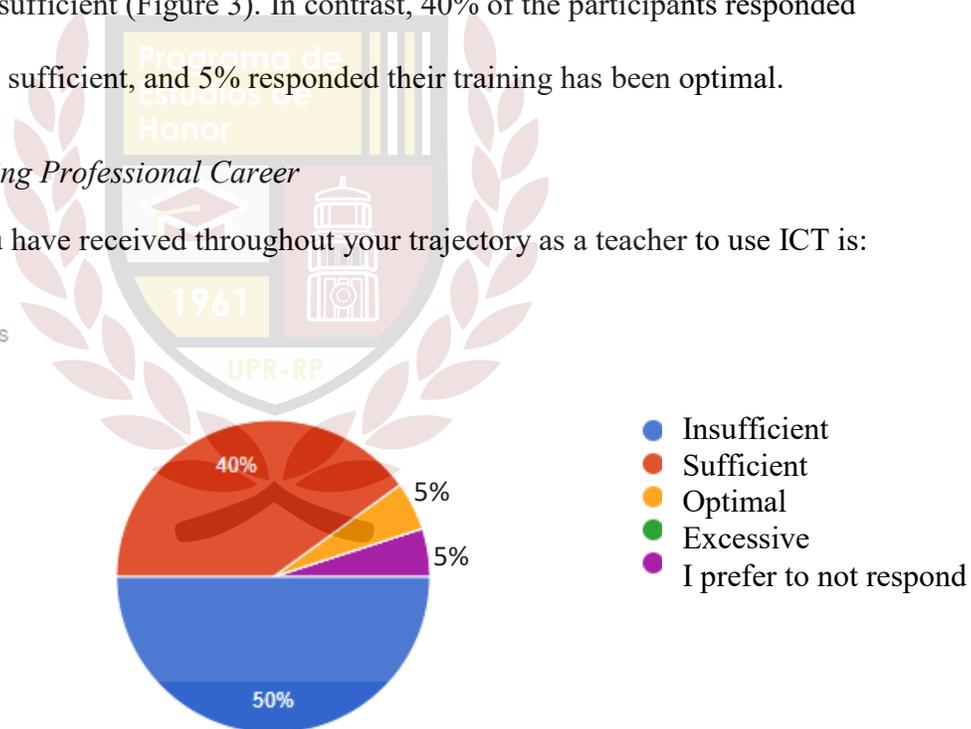


Table 7 data shows that the majority of the participants (85%) responded that they agreed or strongly agreed that they needed more training to use ICT in the classroom. Only 15% of the participants disagreed with the need for training.

Table 7. *Need for Training*

Variable	<i>n</i>	%
I need more training to use ICT in the classroom.		
Strongly Agree	5.00	25.00
Agree	12.00	60.00
Disagree	3.00	15.00

The following research question was to study the relationship between the level of usage and years teaching, availability of resources, technical support, training, and funding. Figure 4 describes the relationship between level of usage and years teaching. The analysis shows, 57.9% of the participants utilize ICT several times a day. Of these participants, 36.4% have been teaching 10 years or less, 36.4% have been teaching 11 to 20 years, and 27.3% have been teaching 21-40 years.

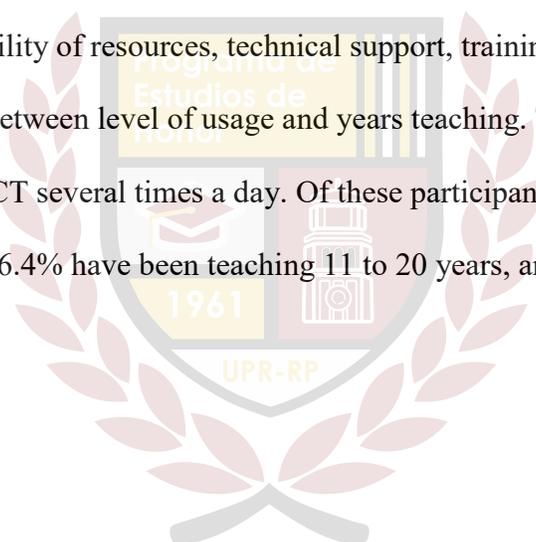


Figure 4. Cross Tabulation: Level of Usage and Years in the Profession

		Years in Profession			Total	
		10 years or less	11 years to 20 years	21 years to 30 years		
Level of Usage	A few times a day	Count	2	1	3	6
		% within Level of Usage	33.3%	16.7%	50.0%	100.0%
		% within Years in Profession	33.3%	16.7%	42.9%	31.6%
		% of Total	10.5%	5.3%	15.8%	31.6%
	Only once	Count	0	1	1	2
		% within Level of Usage	0.0%	50.0%	50.0%	100.0%
		% within Years in Profession	0.0%	16.7%	14.3%	10.5%
		% of Total	0.0%	5.3%	5.3%	10.5%
	Several times a day	Count	4	4	3	11
		% within Level of Usage	36.4%	36.4%	27.3%	100.0%
		% within Years in Profession	66.7%	66.7%	42.9%	57.9%
		% of Total	21.1%	21.1%	15.8%	57.9%
Total	Count	6	6	7	19	
	% within Level of Usage	31.6%	31.6%	36.8%	100.0%	
	% within Years in Profession	100.0%	100.0%	100.0%	100.0%	
	% of Total	31.6%	31.6%	36.8%	100.0%	

As shown in Figure 5, 55% of the participants utilize technology several times a day. Of these 55%, 63.6% agree or strongly agree that they have the necessary ICT resources in their classrooms.

Figure 5. Cross Tabulation: Level of Usage and ICT Resources in the Classroom

		Part 3.4		Total	
		Disagree/Strongly Disagree	Agree/Strongly Agree		
Level of Usage	A few times a day	Count	5	1	6
		% within Level of Usage	83.3%	16.7%	100.0%
		% within Part 3.4	50.0%	10.0%	30.0%
		% of Total	25.0%	5.0%	30.0%
	Only once	Count	1	2	3
		% within Level of Usage	33.3%	66.7%	100.0%
		% within Part 3.4	10.0%	20.0%	15.0%
		% of Total	5.0%	10.0%	15.0%
	Several times a day	Count	4	7	11
		% within Level of Usage	36.4%	63.6%	100.0%
		% within Part 3.4	40.0%	70.0%	55.0%
		% of Total	20.0%	35.0%	55.0%
Total	Count	10	10	20	
	% within Level of Usage	50.0%	50.0%	100.0%	
	% within Part 3.4	100.0%	100.0%	100.0%	
	% of Total	50.0%	50.0%	100.0%	

As seen in Figure 6, 55% of the participants utilize technology several times a day in their classroom. Out of these 55%, 54.5% disagree or strongly disagree that they have been provided continuous support to utilize ICT in their classroom. 45.5% agree or strongly agree that they have been provided the continuous support necessary to utilize ICT in the classroom.

Figure 6. Cross Tabulation: Level of Usage and Support to Integrate Technology

		Part 3.3		Total	
		Disagree/Strongly Disagree	Agree/Strongly Agree		
Level of Usage	A few times a day	Count	6	0	6
		% within Level of Usage	100.0%	0.0%	100.0%
		% within Part 3.3	46.2%	0.0%	30.0%
	Only once	% of Total	30.0%	0.0%	30.0%
		Count	1	2	3
		% within Level of Usage	33.3%	66.7%	100.0%
	Several times a day	% within Part 3.3	7.7%	28.6%	15.0%
		% of Total	5.0%	10.0%	15.0%
		Count	6	5	11
	Total	% within Level of Usage	54.5%	45.5%	100.0%
		% within Part 3.3	46.2%	71.4%	55.0%
		% of Total	30.0%	25.0%	55.0%
Total	Count	13	7	20	
	% within Level of Usage	65.0%	35.0%	100.0%	
	% within Part 3.3	100.0%	100.0%	100.0%	
		% of Total	65.0%	35.0%	100.0%

As seen in Figure 7, 55% of the participants indicated that they utilize technology several times a day. Of these 55%, 72.7% agreed or strongly agreed that they had been provided the necessary training to integrate technology into the classroom. 27.3% of these 55% disagree or strongly disagreed that they had been provided the necessary training to integrate technology into the classroom.

Figure 7. Cross Tabulation Level Usage and Necessary Training Provided

		Part 3.2			Total
		Disagree/Strongly Disagree	Agree/Strongly Agree	I prefer not to respond	
Level of Usage	Count	4	2	0	6
	A few times a day				
	% within Level of Usage	66.7%	33.3%	0.0%	100.0%
	% within Part 3.2	57.1%	16.7%	0.0%	30.0%
	% of Total	20.0%	10.0%	0.0%	30.0%
	Count	0	2	1	3
	Only once				
	% within Level of Usage	0.0%	66.7%	33.3%	100.0%
	% within Part 3.2	0.0%	16.7%	100.0%	15.0%
% of Total	0.0%	10.0%	5.0%	15.0%	
Several times a day	Count	3	8	0	11
	% within Level of Usage	27.3%	72.7%	0.0%	100.0%
	% within Part 3.2	42.9%	66.7%	0.0%	55.0%
	% of Total	15.0%	40.0%	0.0%	55.0%
Total	Count	7	12	1	20
	% within Level of Usage	35.0%	60.0%	5.0%	100.0%
	% within Part 3.2	100.0%	100.0%	100.0%	100.0%
	% of Total	35.0%	60.0%	5.0%	100.0%

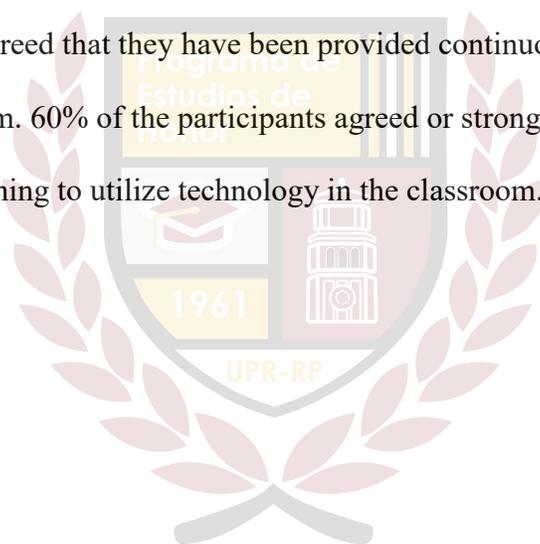
In Figure 8, out of 55% participants that use ICT several times a day, 90.9% agree or strongly agree that they need more training to use ICT in the classroom. 9.1% of these 55% disagreed that they need more training to use ICT in the classroom.

Figure 8. Cross Tabulation: Level of Usage and Need for Training

		Part 3.8		Total	
		Disagree/Strongly Disagree	Agree/Strongly Agree		
Level of Usage	Count	2	4	6	
	A few times a day	% within Level of Usage	33.3%	66.7%	100.0%
		% within Part 3.8	66.7%	23.5%	30.0%
		% of Total	10.0%	20.0%	30.0%
	Count	0	3	3	
	Only once	% within Level of Usage	0.0%	100.0%	100.0%
		% within Part 3.8	0.0%	17.6%	15.0%
		% of Total	0.0%	15.0%	15.0%
	Count	1	10	11	
	Several times a day	% within Level of Usage	9.1%	90.9%	100.0%
		% within Part 3.8	33.3%	58.8%	55.0%
		% of Total	5.0%	50.0%	55.0%
Count	3	17	20		
Total	% within Level of Usage	15.0%	85.0%	100.0%	
	% within Part 3.8	100.0%	100.0%	100.0%	
	% of Total	15.0%	85.0%	100.0%	

The next research question was to find out if the teachers had they been trained or prepared to use technology. As shown in Figure 3, 50% of the participants responded that the training they had received throughout their trajectory as an educator is insufficient. 40% responded that their training had been sufficient. Furthermore, 95% of the participants agreed or strongly agreed that they would like to obtain more information about how to integrate ICT in their classroom.

The final research question was to identify if the training they received was supported by the school or institution. 80% of the participants agreed or strongly agreed that the school administration encourages the use of technology in the classroom. 65% of the participants disagreed or strongly disagreed that they have been provided continuous support to integrate technology in the classroom. 60% of the participants agreed or strongly agreed that they had received the necessary training to utilize technology in the classroom.



## CHAPTER V

### Discussion

Due to the impact that technology has inside and outside of the classroom, this study aimed to find out what factors affected teachers decisions to utilize ICT in their classroom. The main factors that were observed were: years in the profession, training, support, availability of resources and funding, and the subject they teach. This study was necessary to be able to understand what teachers need to be able not only to use ICT in their classrooms, but to feel comfortable and confident when using it. By addressing these factors, school administrators can provide teachers with the necessary tools to successfully integrate technology into their lesson plans. Additionally, the study gave teachers an opportunity to reflect on their needs as educators, including how they could improve their use of ICT as well.

Utilizing a questionnaire distributed to high school teachers in two schools, the results from twenty teachers were tabulated and analyzed. While the amount of training teachers receive was found to be an important factor, it was surprising to find that this did not have a sufficient impact on how much they used ICT in the classroom. Out of the participants who use ICT several times a day, 90.9% agreed or strongly agreed that they needed more training to use ICT in their classroom. Additionally, a majority of participants (65%) stated that they had not been provided with the necessary training to integrate technology in the classroom, yet a majority (55%) utilize it various times a day. This is contrary to a study by Clarke that demonstrated that teachers require access to training because if not, they will not use the technology and will in turn rely on the using the same methods inside their classroom (2012).

Moreover, another interesting find was that while 50% of teachers disagreed or strongly disagreed that they had the necessary ICT resources in their classroom; 95% of the teachers

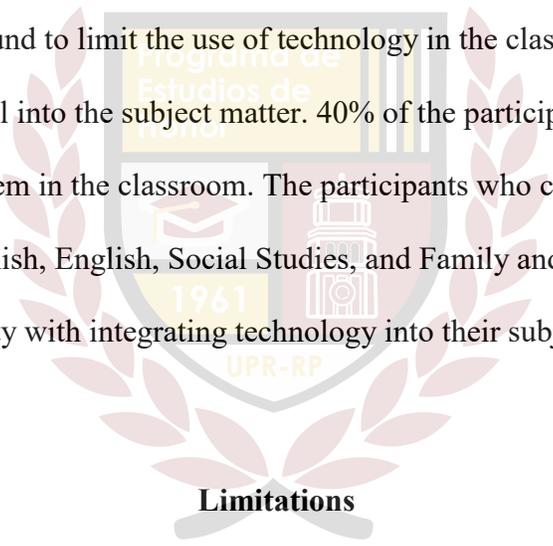
stated that they use computers, cellphones, and Internet/WiFi in their classroom. 85% of the teachers use a projector as well. The findings demonstrate that although the teachers do not believe they have the necessary resources, 95% still uses some type of technological device in the classroom. Out of the technological resources that they use the least, 61% stated a DVD player and 44% stated tablets and IWBs. While IWB use are said to be on a rise (Lai, 2010), the teachers in these two schools use them the least out of all the technological tools they have available.

Fu (2013) found that while school administrations push the use of technology, there is a lack of appropriate administrative support in the school for the use ICT. The results of the questionnaire proved that 80% of the participants agreed that the school administration encouraged the use of technology in the classroom. However, 65% of them disagreed that they had received the support to integrate technology in the classroom. As Fu (2013) elaborates on, school administrators should foster a support system amongst themselves to help teachers with their task to use technology. Providing this support could empower/prepare teachers to integrate the use of ICT more frequently and confidently. As part of the ISTE Standards for Administrators, administrators should “promote an environment of professional learning and innovation that empowers educators to enhance student learning...” (International Society for Technology in Education (ISTE), 2009). Thus, administrators should be providing time and space to make sure the educators who have to utilize this technology are being provided the support to successfully integrate it.

Three main ranges were established for the study and analysis of the relationship between years in the profession and level of usage. Range I consisted of ten years or less, Range II was eleven years to twenty years, and Range III was twenty-one years to thirty years. While age is

found to be an influence on teachers' perception of technology because of its possible barriers (O'Bannon & Thomas, 2014); the results demonstrated that there was an almost equal amount of teachers who use ICT various times a day, no matter the range that they fall in.

The participants who took part in the study varied in the subject matter they teach. The majority (25%) were English teachers, followed by Math teachers (20%), and then Spanish and Science with (15%). While De Jesús (2005) found that math teachers are more prone to use technology than science teachers, the study found that both the math and science teachers that participated all utilize technology several times a day. Additionally, one of the main non-technological problems found to limit the use of technology in the classroom is being able to adapt the technological tool into the subject matter. 40% of the participants responded that this was a main problem for them in the classroom. The participants who confronted this problem teach: Math, Science, Spanish, English, Social Studies, and Family and Consumer Science. No matter the subject, difficulty with integrating technology into their subject matter is a common factor.



### **Limitations**

One of the limitations of this study is that it was only completed in a laboratory school and a specialized school in Puerto Rico. Consequently, they tend to have better resources than the general public schools. For these reasons, the two schools used for the study had a higher rate of technological use due to the fact that they were more prone to have the resources available. Moreover, the sample size should also be bigger for further studies to have a wider understanding of the use of technology among teachers at all type of school environments. Lastly, the questionnaires were distributed via email with a link to the Google Form. By sending the questionnaire through a Google Form, there was an automatic limitation in that only those

with access to technology were able to fill out the questionnaire. For a following study, the questionnaires should be distributed in paper form, rather than through Google Forms.

### **Conclusion**

Schools, especially laboratory or specialized schools, should not take for granted the availability of technological resources as a definition of automatic mastery by their school faculty. Although the teachers in the two schools studied used technology several times a day, a majority responded that they need more training to use ICT and 50% stated that their training throughout their career trajectory had been insufficient. The training teachers receive should not only happen one day a year or even a month, but continuously throughout their career. Teachers need the support and guidance to fully master the technology and therefore integrate it into their classroom. While the data demonstrates that the need for training does not have a significant impact on the use of technology by the teachers, this high rate of use can be contributed to the availability of resources. Furthermore, while 55% of teachers use technology several times a day in their classroom, this does not mean that the technology is being used to the best of its abilities. Just as students require guidance inside the classroom, so do teachers.

Additionally, 70% of teachers considered the amount of time to create the materials using technology to be a big non-technological problem for them in their classrooms. While it was not one of the factors studied, it is apparent that teachers require more time to be able to use technology in their classroom and to create the materials necessary to use it. Teachers already have a heavy workload as it is, which means the extra time to create materials to use ICT is too much. Training and amount of time to use ICT were proven to be the biggest factors that teachers consider limiting to integrate technology.

Teaching is a rigorous career that demands the use of various teaching strategies, including integrating technology. Understanding what affects a teacher's use of ICT inside the classroom will help identify the support teachers require while easing their workload.

Technology will continue to play a big role in student learning and teachers should be given the resources, the time, the support, and most importantly, the necessary training to master these skills and be comfortable in their own classrooms.

### **Recommendations**

Based on the limitations of the study stated above, it is recommended that this study be conducted in public schools in Puerto Rico. The schools chosen for the study were laboratory schools who had a much greater access to technological resources inside of their classrooms. Conducting the study in public schools could greater insight into how technology is used, if it is used, and what factors contribute to its use. Furthermore, the following study should focus on how effectively ICT is being used in the classroom, rather than if it is simply being used. A study on how teachers use the technology in their classroom is necessary to understand if teachers have an actual mastery of the ICT in their classroom. Lastly, schools should implement a system of support for teachers to motivate and create continuous learning for the use of technology inside the classroom. For a future study, the time that teachers have to dedicate to creating materials for their classes using ICT should be a factor that should be studied. It was found that the teachers (70%) considered this factor to be a big problem for them in their classrooms. Therefore, while teachers demonstrated a want to learn and to use ICT in their classroom, they also demonstrated a worry about the amount of time they have to actually prepare materials using ICT.

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## Appendix A

Universidad de  
Puerto Rico

COMITÉ INSTITUCIONAL PARA LA PROTECCIÓN DE LOS SERES HUMANOS  
EN LA INVESTIGACIÓN (CIPSHI)  
IRB 00000944

**AUTORIZACIÓN DEL PROTOCOLO**

Número del protocolo: 1718-115

Título del protocolo: Factores que facilitan o limitan el uso de la tecnología en el salón

Investigadora:

Nidia Liz Matos Ramos

Tipo de revisión:

Inicial  Renovación  Modificación

Revisado por:

Comité en pleno

Procedimiento expedito bajo la categoría del *Federal Register* 63 FR 60364-60367: 7

Fecha de la revisión: 31 de mayo de 2018

Otras acciones:

Condiciones verificadas y aprobadas por  Miembro del CIPSHI  Personal de Cumplimiento el 13 de septiembre de 2018.

Revisión continua cualifica para la evaluación expedita.

***Esta autorización expira el 13 de septiembre de 2019.***

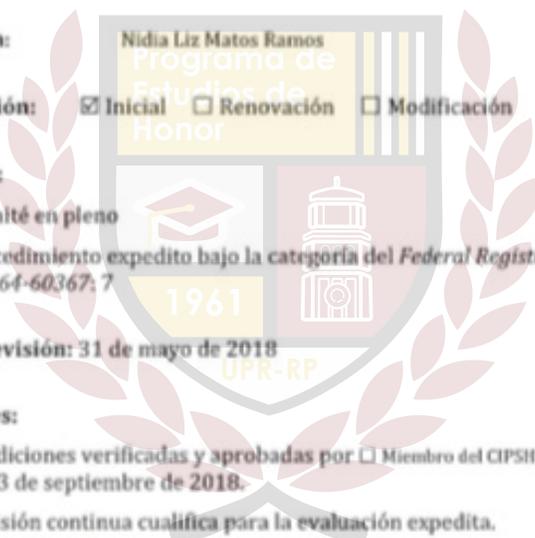
*Si la investigación no concluye para esta fecha, tiene que solicitar la renovación de la autorización de acuerdo al tipo de revisión que le corresponda, por el comité en pleno o expedita. Cualquier modificación posterior a esta autorización requerirá la consideración y reautorización del CIPSHI. Además, debe notificar cualquier incidente adverso o no anticipado que implique a los sujetos o participantes. Al finalizar la investigación, envíe el formulario de Notificación de Terminación de Protocolo.*

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Presidenta del CIPSHI



## Appendix B

## Questionnaire: Factors that facilitate or limit the use of technology in the classroom

### Purpose:

This instrument has the purpose of identifying factors that may or may not play a role in influencing the use of technology in the classroom. It is constituted of four parts. The first part focuses on demographics. The second part consists of ten questions that deal with attitudes towards ICT in the classroom. The third and fourth parts are made up of twenty-two questions that focus on the time, knowledge, preparation and overall use of technology in the classroom.

### For the purposes of this study:

1. ICT – Information and Communications Technology, which can include computers, projectors, mobile devices, tablets, the Internet, etc.

### Instructions:

Mark an X in the box that best describes your answer.

### Part I: Demographics

#### Gender

Female	Male
--------	------

Age: \_\_\_\_\_

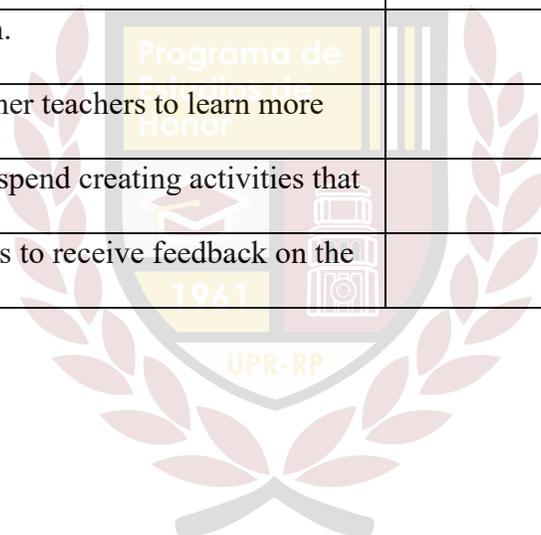
Years Teaching: \_\_\_\_\_

#### Subject:

Math	Language Arts
Art	Social Studies
Spanish	Physical Education
Science	Other: _____

**Part II: Attitude**

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I feel prepared enough to integrate technology into my lesson plans.				
2. I am worried about my students' attitudes toward the use of ICT.				
3. I feel that ICT is a distraction in the classroom.				
4. I would like more information about how to integrate ICT in my classroom.				
5. I want to use ICT more in the classroom.				
6. I am worried about my capacity to use ICT in the classroom.				
7. I enjoy using ICT in my classroom.				
8. I am open to collaborating with other teachers to learn more about ICT.				
9. I am worried about the time that I spend creating activities that implement ICT.				
10. I would like to talk to my students to receive feedback on the use of ICT.				



### Part III: Knowledge/Time

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. The school administration encourages the use of technology in the classroom.				
2. I have been provided the necessary training to integrate technology in the classroom.				
3. I have been provided continuous support to integrate technology in the classroom.				
4. I have been given the necessary ICT resources in the classroom.				
5. ICT in the classroom facilitates learning.				
6. I would like to decrease the amount of time I use ICT in my lesson plans.				
7. I would like to increase the amount of time I use ICT in my lesson plans.				
8. I need more training to use ICT in the classroom.				
9. I do not have the resources in my classroom to use ICT.				
10. I do not have the sufficient time to learn how to use ICT.				

### Part IV

Which technological tools do you utilize in your classroom? Check all that apply

<input type="checkbox"/>	Computer	<input type="checkbox"/>	Cellphone
<input type="checkbox"/>	Tablet	<input type="checkbox"/>	Projector
<input type="checkbox"/>	Interactive Whiteboard	<input type="checkbox"/>	TV
<input type="checkbox"/>	Internet/WiFi	<input type="checkbox"/>	DVD player

Which technological tool do you use **most** in your classroom? Check all that apply.

<input type="checkbox"/>	Computer	<input type="checkbox"/>	Cellphone
<input type="checkbox"/>	Tablet	<input type="checkbox"/>	Projector
<input type="checkbox"/>	Interactive Whiteboard	<input type="checkbox"/>	TV
<input type="checkbox"/>	Internet/WiFi	<input type="checkbox"/>	DVD player

Which technological tool do you use **least**? Check all that apply.

Computer	Cellphone
Tablet	Projector
Interactive Whiteboard	TV
Internet/WiFi	DVD player

What do you **most use** these technological tools for? Check all that apply.

Communication with students	Entertainment
Teaching	Evaluation
Communication with parents	Planning
Other:	Other:

Indicate the software that you utilize to **support the development** of your class:

Word	Excel
PowerPoint	Publisher
Program associated with an Interactive Whiteboard	Movie Maker
Google Drive	Dropbox

What programs do you use to **communicate** with students? Check all that apply.

Blogs	Emails
Chats	Personal Page
Educational Platform	Facebook
Mobile Apps (Whatsapp)	Other: _____

What problems (not technological) have you encountered while utilizing technology in the classroom?

Inclusion of students with disabilities or special needs	Time to develop the materials
Apathy or boredom from the students	Fit the technological tool into the subject I teach
Lack of knowledge in the management of these tools	Other: _____

Do you digitally share the materials you utilized in the classroom with your students?

Yes	No
Only for those that require it	Other: _____

The training you have received throughout your trajectory as a teacher to use ICT is:

Insufficient	Sufficient
Optimal	Excessive

How frequently do you use ICT in your classroom on a daily basis? Check the one that best describes your experience.

Several times a day	A few times a day
Only once	Never

How would you rate yourself on your level of knowledge in using ICT? Check the one that best describes your experience.

Advanced	Proficient
Developing	None

From your point of view, which are the advantages and disadvantages of using ICT in the classroom?

	Advantage	Disadvantage
Availability of resources		
Training		
Communication		
Optimization of time		
Distractions		
Information		
Visual Aids		
Motivation		
Competencies		
Goals met		
Specialist Teachers		

## Appendix C

12 de mayo de 2018

A quien pueda interesar,

Yo, Dra. Carmen Pacheco, he revisado el cuestionario de la estudiante Nidia Liz Matos Ramos y autorizo su adaptación de mi cuestionario para su investigación sobre, "Los factores que facilitan o limitan el uso de la tecnología en el salón de clases."

Atentamente,



Dra. Carmen Pacheco  
[carmen.pacheco3@upr.edu](mailto:carmen.pacheco3@upr.edu)

Directora del Departamento de Artes, Tecnologías e Innovación,  
Facultad de Educación, UPRRP





12 de diciembre de 2019

Estudiantes egresados del PREH Segundo Semestre 2018-2019

  
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