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Use of Technology and Podcast Adoption Among Members of a Higher Education Community: An Institutional Case Study

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Abstract: Academic literature makes evident the integration of technologies related to Web 2.0, including podcasts, into higher education settings. The potential of podcasts as an educational tool has been highlighted by researchers for its portability and flexibility. However, there is no relevant information about the use or adoption of podcasts in higher education settings in Puerto Rico. The general objective of this research was to seek a better understanding of the use of digital technologies by faculty and students in Puerto Rico; as well as their knowledge, use and potential adoption of podcasts in the academic setting. An institutional case study was conducted with a quantitative approach. Data was collected by administering an online survey to faculty members and students of three campuses of a private higher education institution located in Puerto Rico. A total of 87 full-time faculty members and 447 students answered the survey. In general, the use of digital technology by the participants in our study is quite similar to the use reported in other large-scale surveys. When asked about podcast utilization as part of some course, more than 78% of the faculty members and students reported never using it. About 70% of both groups consider its potential use as an instructional resource is adequate. As evidenced by students' perception, podcast adoption as an educational resource depends on content, length, usefulness, and entertaining value. On the other hand, podcast acceptance by faculty members depends on working conditions and technological competencies.

Key-words: podcast adoption; technology use; higher education; educational technology; digital technology; educational tool.

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1. Introduction

Data from *The Infinite Dial* report evidences the impact of digital technology, including social media, among consumers in the United States (Edison Research, 2021). Educational settings have also experienced this trend. Recent academic literature makes evident the integration of social media and other technologies related to Web 2.0 in higher education (Blum, 2018; Figueras-Maz, Ferrés, & Mateus, 2018; Justus, 2017; Matava, Rosen, Siu, & Bould, 2013; Pegrum, Bartle, & Longnecker, 2015; Pinto & Leite, 2020). These technologies have been tested in schools and universities to support the educational process of students through innovative strategies (Justus, 2017).

Podcasts are a social web technology that has seen dramatic growth during the last 15 years (Edison Research, 2021). Their potential as an educational tool was highlighted from the beginning of this period, where podcasts applications were the subject of research (Hew, 2009). As Trujillo Torres concluded in his research, "the strength and potential of this educational resource appear to be numerous and attractive", perceiving podcasts as a promising teaching tool to integrate pedagogical strategies with technology (2011, p.238). Since then, there has been a growing application of podcasts across different institutional contexts in higher education and academic disciplines, which led Gachago, Livingston, and Ivala (2016) to conclude that podcasting "is a technology-supported pedagogical practice that is well researched and has reached maturity in many contexts…[and] is seen as a useful tool to help students revise and deepen their content knowledge" (p. 860). These researchers also concluded that "studies on podcasting often yield contradictory results in terms of students' uptake and perceptions of the value and usefulness of podcasting…[and] critiques of podcasting refer to podcasting's potential to support passive and teacher-centred learning" (p. 860).

However, there is practically no relevant information about the use or adoption of podcasts in the academic setting by faculty and students in Puerto Rico. The results of the research discussed in this paper are intended to fill this gap and insert our national setting in the broader discussion of podcasts in the teaching-learning process at the university level.

2. Background

2.1. Technologies used for academic purposes

Based on estimates provided by *The Infinite Dial* report (Edison Research, 2021), 88% of the U.S. population aged 12 years or older, own a smartphone, 51% owns a tablet, 46% has ever listened to an audiobook, 82% uses social media (61% use Facebook, 43% Instagram, and 31% uses

Pinterest), and 78% is familiar with podcasting. The data shows how technology is impacting our society, and educational activities are not exempt from this trend.

There are digital technologies used in higher education learning (e.g., video conferencing, discussion boards, blogs, wikis, MOOCs, mobile learning, social media, podcast) to promote knowledge sharing (Celaya, Ramírez-Montoya, Naval, & Arbués, 2020; Gonzalez & Moore, 2020; Tulinayo, Ssentume, & Najjuma, 2018) and accommodate to different learning needs. As these technological innovations become more central in our society, higher education institutions "have little choice but to adopt initiatives that provide mechanisms for more flexibility and engagement" (Zacharis, 2012, p. 171). Among these technological innovations, podcasting has "had a rapid rise in popularity" (Goldman, 2018, p. 2) and "has enjoyed growing interest in education studies literature over the past decade" (Drew, 2017, p. 201). However, technology adoption and creation of content, including podcasts, do not necessarily depend on how the instructional process is delivered in traditional face-to-face or other emerging formats, such as distance and online education. The application of Web 2.0 technologies is also deemed essential to engage students in online courses (González & Moore, 2020).

Regarding course delivery methods, the percentage of US college faculty members who have taught an online course has been steadily growing since 2013, according to the *2019 Survey of Faculty Attitudes on Technology* (Jaschik & Lederman, 2019), increasing from 30% in 2013 to near half (46%) in 2019. Nevertheless, the *Time for Class - COVID-19 Edition Part 1: A National Survey of Faculty during COVID-19* (Fox, Bryant, Lin, & Srinivasan, 2020) reported that 91% of the participant US higher education faculty were teaching face-to-face courses and had to transition to remote delivery in response to the COVID-19 pandemic. Of those, fewer than half "reported that they had taught online before and thus were teaching in a remote delivery format for the first time" (p. 7). But overall, 51% of the surveyed faculty had taught an online class prior to COVID-19 (p. 14). This percentage is in a similar range of that informed by Jaschik and Lederman (2019).

Examining undergraduate students' longitudinal data from 2000 to 2012, Ortagus (2015) found that the proportion of students taking some online course increased from 3.4% in 2000 to 19.2% in 2012; and students taking all courses online grew from 2.2% in 2000 to 7.5% in 2012. Gonzalez and Moore (2020), citing the work of Allen and Seaman (2017), establish that 29.7% of all enrolled higher education students took at least one online course as of 2015 (p. 223). According to *The Condition of Education 2020* (Hussar et al., 2020), 34% of all undergraduates and 40% of postbaccalaureate students were enrolled in any distance course in the US during Fall 2018.

Some might argue that after the pandemic, these percentages will not be that different than before this event because *emergency remote teaching* is not the same as online teaching (Hodges, Moore, Lockee, Trust, & Bond, 2020, March 27). Emergency remote teaching is defined as the "temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances […] and that will return to that format once the crisis or emergency has abated" (p. 7). A comparative exploratory study conducted in three different national settings (Spain, Italy, and Ecuador), where students and faculty from Journalism, Communications, and Education were surveyed, revealed that during the COVID-19 pandemic and resulting transition to remote teaching, there was a lack of innovative strategies on the part of participating faculty members (Tejedor, Cervi, Pérez-Escoda, Tusa, & Parola, 2021). This result contrasts to the position of participating students, who "demand a more multimedia-based offer that combines resources of different types, while claiming a greater role for the podcast" (p.13). In fact, other studies conducted during the pandemic have shown that educational audio podcasts could be relevant in a confinement environment, because: (a) they are small size files compared to other media, making them ideal for people with a poor internet connection; (b) its production is simple, fast and cost-effective; and (c) the editing software can be found in free and easy-to-use applications (Anteby et al., 2021; Barnes, Carraway, & Jones, 2021; Nalendra et al., 2020). These findings support the argument that no matter the instructional format, either face-to-face, online, or remote; it is relevant to address the creative development of educational content that incorporates emerging technological resources such as podcasts.

2.2. Podcasts

A podcast is a digital file, audio or video, that can be heard instantly or downloaded to computers or portable media players (Alarcón, Blanca, & Bendayan, 2017; Pegrum et al., 2015). It usually refers to a series of episodes that are released and can be subscribed to using a Really Simple Syndication (RSS) feed (Strickland, Gray, & Hill, 2012). Another important feature of podcasts is that these digital files can be listened to as many times as the listener wants (Blum, 2018). In its early stages, podcasts were principally related to the growing use of iPods, which led higher education institutions to test podcasting as an instructional strategy (McCombs & Liu, 2007, p. 124). This growing interest led Apple Computers, Inc. to develop iTunes University, a website that made podcasts available to be downloaded for educational purposes (McKinney, Dyck, & Luber, p. 617).

In higher education, there are at least three types of podcast uses (Pegrum et al., 2015, pp. 144–145): substitutional, creative, and supplementary. The substitutional podcast is a tutorial or faculty lecture that is recorded and made available to students so that they can review it as many

times as they want. The creative podcast refers to the one that the student develops as part of a course to help them understand a course topic. Finally, the supplementary is the podcast that serves as additional information to the course to help deepen what was discussed in it. It should be acknowledged that these types could include video podcasts (Luttenberger et al., 2018) as well as audio.

2.2.1. Podcast Use

The percentage of people age 12 and older who have ever listened to a podcast increased in the United States from 11% in 2006 to 57% in 2021 (Edison Research, 2021). During this same period, the percentage of people in that age group, who had listened to a podcast *in the last month*, increased from 9% to 41% and *in the last week* it increased from 7% to 28%. The highest percentage of people who listened to a podcast *in the last month* were men (51%), of white ethnicity (68%), and from the 12 to 34 years old age group (50%) (Edison Research, 2021). At least until 2019, this age group had a relatively high educational and economic profile compared to the general population (Edison Research, 2019). The main advantage that podcast users from the 2019 report perceived was related to the flexibility offered by the medium: (a) other things can be done while listening, (b) it is portable, and (c) it can be listened to practically anywhere (Edison Research, 2019). These features are precisely what are perceived by students as a useful instructional resource (Pinto & Leite, 2020).

The rise of the podcast as a means of communication is not limited to the United States. The Latin American community called *Podcaster@s* carried out a non-probabilistic online survey, with 2,153 responses, mainly from people 16 years and over (Podcaster@s, 2019). Several findings from this survey coincide with those found in the United States: (a) interest in learning new things is one of the main reasons why they listen to podcasts, (b) 30% started listening to podcasts between 2018 and the moment in which they completed the survey (which reaffirms the growth of the medium), and (c) the perception of flexibility offered by the medium is reaffirmed since it can be heard in different places and when carrying out different activities.

2.2.2. Podcasts and Puerto Rico

The history of podcasting in Puerto Rico is somewhat difficult to decipher, as the most popular podcast databases do not recognize Puerto Rico as a country, causing local production to be lost among United States podcasts (Vargas, 2019). There seem to be three important historical moments in the country in terms of podcasting: the period from 2005-2011, the period from 2011-13 and the period from 2017 to present (Vargas, 2019). Between 2005 and 2011 a limited but stable number of podcasts appears in Puerto Rico. In the period from 2011 to 2013, religion and spirituality podcasts had a

significant increase, ranking as the category with the most podcasts in Puerto Rico. Starting in 2017, "an explosion began in the production of independent podcasts" (Vargas, 2019).

A report from the Puerto Rico Podcast Observatory (Observatorio de Podcast de Puerto Rico, 2021) reveals that there has been a considerable increase in the number of podcast episodes since 2018, after the passage of Hurricane María through the island and the restoration of communications; exactly tripling the number of episodes in relation to the number that existed before the hurricane. This data on the increase in the availability of episodes coincides, as a trend, with the data for Latin America of the high percentage of people who listened to a podcast for the first time since 2018.

2.2.3. Podcast as an educational resource

The incorporation of the podcast as an educational resource was relatively fast if we consider that by 2009 a comprehensive meta-analysis had already been carried out on the use of the medium, which had only just started to become popular a few years earlier. Hew (2009) analyzed 30 research articles that addressed the use of the podcast in learning environments, particularly at the higher education level. According to the author, podcasting can respond to two practices: (a) use existing resources or (b) create one, in which case it can be created by the faculty or by the students as part of a class project. Those podcasts that are created by the faculty can have different approaches; such as, for example, reproducing the content of the class or supplementing the content of the class (e.g., reinforce concepts discussed in class, introduce concepts to connect content between classes). Two thirds of the research analyzed by Hew corresponded to disciplines related to natural sciences, engineering, and technology.

The use of podcasts as an educational resource has not varied much as it is inferred from research with dates later than those reviewed by Hew (Alarcón et al., 2017; Blum, 2018; Chester, Buntine, Hammond, & Atkinson, 2011; Ng'ambi & Lombe, 2012; Van Zanten, Somogyi, & Curro, 2012). Podcast types tend to be similar too, with minor variations: (a) reproduce course content, (b) offer supplemental material, which may have several variations, and (c) produced by students as part of a class project. As expected, the number of academic disciplines in which podcast use has been incorporated has increased. However, the studies outlined in the articles by Alarcón et al. (2017) and Chester et al. (2011) tend to suggest that use continues to be concentrated in the disciplines identified by Hew (2009), in addition to those related to health professions.

One of the findings from the meta-analysis (Hew, 2009) was that students tended to listen to podcasts on desktop computers, rather than the mobile phone. One possible explanation for this is that, being a course activity, students preferred to focus on the activity itself (e.g., to make notes).

It should be noted that 10 years ago, the use of mobile phones was not as widespread as today, nor was the technology of these devices as highly developed. However, the results of a study by Khechine, Lakhal, and Pascot (2013) reach the same conclusions as those reviewed by Hew.

Carvalho et al. (2009) characterize the length of the podcasts as: (a) short (1-5 minutes), (b) moderate (6-15 minutes), or (c) long (16 minutes or more). Matava et al. (2013) suggest that the preference for the duration of a podcast depends on the content. For example, among 151 medical residents who participated in their research, 40.4% preferred the podcast to last between 15 and 30 minutes if the content was a didactic conference. In contrast, the majority preferred between 5 and 15 minutes if the contents were related to more specific topics (e.g., case presentations). This result tends to support Hew's observation that the duration of an educational podcast will depend on (a) the content of the subject, (b) the perception of the usefulness of the podcast, and (c) the requirement mandatory to listen to it (2009, p. 342).

The effects of incorporating podcasts on student learning has not been researched as much as its adoption and attributes. This topic needs a deeper understanding based on more complex research designs. According to Hew (2009), the studies that were part of his meta-analysis showed that podcasts have positive effects on: (a) affective outcomes and (b) learning outcomes when measured by student's self-reports. However, the effect of using podcasts have mixed results when measured with more structured research designs (e.g., experimental, quasi-experimental). Fernández, Sallan, and Simo (2015) concluded that research on the effects on students' learning is still in an embryonic stage and propose three "lines of investigation", which are related to the impact of: (a) podcast use, (b) podcast elements, and (c) context where it is use. In addition, Fernández et al. highlighted the complexities of podcast research:

The quantity of podcast elements, the large number of contextual aspects of a course, and their interaction make the study of podcasting complicated and laborious. Nevertheless, the majority of researchers, even the most skeptical, recognize the need to continue researching this topic. (p. 326)

2.3. Podcast technology adoption

Research on technology adoption has been around since the 1980s with notable contributions from the fields of management, sociology, education, economics, information systems, communication, and psychology, among others (Mou & Lin, 2015, p. 476; Ogrezeanu, 2015, p. 56). Some of the most used models and theories proposed to explain people's acceptance of new technologies and their intention to use are: Roger's Theory of diffusion of innovations (DoI), Fishbein and Ajzen's Theory of reasonable action (TRA), Ajzen's Theory of planned behavior (TPB), and the Technology Acceptance Model (TAM) in its different iterations (Koul & Eydgahi, 2017; Lai, 2017;

Ogrezeanu, 2015). These theories and models focus on an array of variables when explaining and measuring the adoption of new technologies, for example: attitudes, subjective norms, behavioral intention, and perceived usefulness (Koul & Eydgahi, 2017; Lai, 2017; Ogrezeanu, 2015).

Studies specifically exploring podcast technology adoption have used adaptations of the mentioned theories and models. For example, Zacharis (2012) modified the TAM by including *perceived enjoyment* as an independent variable that impacts both *perceived ease of use* and *behavioral intention* (p. 174). Mou and Lin (2015) used the TPB in their study but divided the *subjective norms* variable into *descriptive* and *injunctive* norms, and Merhi (2015) merged the TAM with the DoI to create his podcast adoption model. But social scientific research on podcast diffusion and adoption remains scarce (Mou & Lin, 2015, p. 476) in general, and specifically among students (Merhi, 2015, p. 33). It should be noted that our study did not intend to examine any specific adoption model or theory but rather explore general perceptions about podcast technology adoption.

2.4. Objectives

Considering what was previously discussed, we took on the task of seeking a better understanding of digital technologies by faculty and students in Puerto Rico and their knowledge, use, and potential adoption of the podcast in an academic setting. Specifically, we wanted to: (1) explore the use of digital technologies among students and faculty of a private multi-campus higher education institution, (2) determine the level of knowledge that students and faculty of a private multi-campus higher education institution have about the technological tool known as a podcast, (3) explore the use of the podcast among students and faculty of a private multi-campus higher education institution, and (4) know the perception that students and faculty of a private multi-campus higher education institution have about the adoption of the podcast as an instructional resource.

3. Method

To achieve the proposed objectives, we conducted an institutional case study with a quantitative approach. Although most case studies are associated with qualitative research, particularly in educational settings (Bassey, 1999), in this case the term is used to emphasize that it was conducted in a specific institutional context and its non-inferential purpose. Selection of the case study approach as a research design allowed us to have an initial empirical exploration on the topic on which future research will be developed. These clarifications address some criticism about the application of the term *case study* in social research (Tight, 2010). As part of the research design, data was collected through the administration of an online survey about the knowledge

and use of technology, particularly in relation to the adoption of podcasts as an instructional resource in higher education. Next, we describe: (a) survey's participants, (b) the data collection instruments, and (c) the data analysis.

3.1. Participants

The online survey was administered to the population of faculty members and students of three campuses of a private higher education institution located in Puerto Rico. These included: (a) 272 full-time faculty members who were active for the second semester (January through May) of the academic year 2019-2020, and (b) 19031 students officially enrolled for the same academic session. The decision to recruit participants from all the population of full-time faculty members and students was based on the fact that it is not feasible to access or create a sampling frame of technology users, even less of podcast users.

Participants, both faculty and students, were invited through the institutional email to follow a URL link to the digital questionnaire placed on an area in the university's intranet. This process is consistent with what is defined as an online survey, including internet-based surveys (Vehovar & Manfreda, 2017). The original survey design included two follow-up reminders after the initial invitation at the end of February 2020. This research phase was not fully implemented due to the COVID-19 outbreak and its consequent disruption of the academic processes in all higher education institutions in Puerto Rico since mid-March. The final response rate was 32.0% (87 responses) for full-time faculty members and 2.3% (447 responses) for students. The rate takes into consideration those who accessed and completed the online questionnaire after consenting to participate.

Many factors may influence the decision to answer an online survey, including "topical self-selection" (Lehdonvirta, Oksanen, Räsänen, & Blank, 2020, p. 6). It is reasonable to argue that the questionnaire was answered by those with a greater disposition to the topic of technology, causing a "non-response bias".

However, this does not represent a problem because the purpose is not to measure a population parameter, but to assess the disposition to adopt digital audio files as an instructional resource, considering the knowledge and use of respondents' technology. The emphasis is on "circumstances and behavior" regarding a "low-incidence sub-group" due to "novel social phenomena" (Lehdonvirta et al., p. 9); in this case, podcasting.

Although this study is non-inferential, a chi-square test of goodness-of-fit was performed to determine whether the respondents' distribution on selected variables was the same as the population's distribution. Full-time faculty members' distribution of respondents by gender and academic unit affiliation was not statistically different from that of the population (see Table

1). Following Cohen's general guidelines (1988), the effect size was "small" for gender and "medium" for academic affiliation.

Variable	**Population**		**Survey participants**	
	N=272	%	n=87	%
Gender [a]				
Female	171	62.9	55	63.2
Male	101	37.1	32	36.8
Academic unit [b]				
Health Sciences	79	29.0	24	27.6
Social Sciences, Communications and Education	84	30.9	23	26.4
Business and Tourism	46	16.9	18	20.7
Natural Sciences	38	14.0	10	11.5
Other [c]	25	9.2	12	13.8

[a] Chi-square (1, n = 87) = .05, p >.05 (Critical value = 3.84), Cramer's V = .02
[b] Chi-square (4, n = 87) = 3.57, p > .05 (Critical value = 9.49), Cramer's V= .10
[c] Includes units with non-traditional offerings (e.g., accelerated, online, and technical studies).

Table 1. Distribution of full-time faculty members by gender and academic unit affiliation

On the other hand, Chi-square goodness-of-fit tests performed on selected variables (i.e., gender, academic unit, and age) revealed that the distribution of the student respondents differed significantly from that observed in the population (see Table 2). In this case, non-significant results are not surprising given the relatively large size of the sample (n=447). In fact, the effect size was "medium" for gender and age group, and "small" for academic unit. In general, the distribution in the selected variables of those that responded to the questionnaire approximated reasonably well the distribution of the population.

Variable	**Population**		**Survey participants**	
	N=19031	%	n=447	%
Gender [a]				
Female	12346	64.9	345	77.2
Male	6685	35.1	100	22.4
Other	-	-	2	0.4
Academic unit [b]				
Health Sciences	3466	18.2	76	17.0
Social Sciences, Communications and Education	3982	20.9	121	27.1
Business and Tourism	3491	18.3	72	16.1
Natural Sciences	881	4.6	27	6.0
Other [c]	7211	37.9	151	33.8

Age group [d]				
19 or under	3111	16.4	54	12.1
20 - 24	7158	37.6	144	32.2
25 - 29	3082	16.2	67	15.0
30 - 34	1999	10.5	48	10.7
35 - 39	1437	7.6	38	8.5
40 - 44	1078	5.7	38	8.5
45 - 49	624	3.3	26	5.8
50- 54	307	1.6	22	4.9
55 or older	221	1.2	10	2.2

[a] Chi-square (1, n = 445) = 30.95, p < .05 (Critical value = 3.84), Cramer's V = .26. Two cases ("other") from the sample were excluded from the calculation of the test.
[b] Chi-square (4, n = 447) = 12.91, p < .05 (Critical value = 9.49), Cramer's V = .08
[c] Includes units with non-traditional offerings (e.g., accelerated, online, and technical studies).
[d] Chi-square (8, n = 447) = 61.33, p < .05 (Critical value = 15.51), Cramer's V = .13

Table 2. Distribution of students by gender, academic unit, and age

3.2. Instruments

Two questionnaires (one for faculty and one for students) were created using Microsoft Office 365 Forms to collect the study data. The questionnaires were administered by email with an URL link that directed participants to the platform where the survey was located. The survey specifications in Microsoft Forms limited access to institutional emails but did not save the email information or link responses to individual identifiers. The research protocol, including the two questionnaires, was approved by the university's Institutional Review Board, which served as the setting for this case study.

Both questionnaires are practically identical in content, but some questions or premises were adapted depending on the participant's role in the academic setting. Completing each questionnaire took approximately 15 minutes. Both instruments were developed in Spanish by the researchers based on an extensive literature review.

The instruments have four sections, of which the first seeks to gather general information of the study participants (e.g., gender). The second section explores the use of computers, other technological devices, and social networks among participants (e.g., which of the following electronic equipment or devices is the one you use most frequently?). The third will establish the level of knowledge and use of participants about podcasts (e.g., have you ever listened to a podcast?). Finally, the fourth section explores the adoption of podcasts as an educational resource (e.g., How do you evaluate the idea of using the podcast as an instructional resource for the courses?). Table 3 details the type of information requested in each of the two questionnaires.

Section and type of information requested	Faculty	Students
General information		
Years of experience teaching at the higher education level [a]	x	-
Age [a]	-	x
Academic level in which is teaching [b]	x	
Degree/diploma in which is enrolled [b]	-	x
Gender [b]	x	x
Campus location [b]	x	x
Academic unit [b]	x	x
Use of computers, other technological devices, and social networks		
Experience with online and hybrid courses [b]	x	x
Most frequently used technological equipment or devices [b]	x	x
Activities for which technological equipment or devices are used [b]	x	x
Most frequently used technological equipment or devices for academic activities [b]	x	x
Most frequently used technological equipment or devices for entertainment activities [b]	x	x
Use of social networks [c]	x	x
Use of selected social networks (among users) [b]		
Time spent in social networks (among users) [a]	x	x
Knowledge and use of podcasts		
Level of knowledge about podcasts [d]	x	x
Experience listening to podcasts [c]	x	x
Frequency listening to podcasts (among users) [d]	x	x
Frequency listening to iTunes podcast (among users) [d]	x	x
Favorite podcast platform (among users) [b]		
Main reason to listen podcasts (among users) [a]	x	x
Place where the participant listens podcasts (among users) [b]	x	x
Level of importance of podcasts' features (among users) [d]	x	x
Recommended time duration of a podcast [a]	x	x
Frequency of time dedicated to listening to the entire duration of a podcast (among users) [d]	x	x
Favorite podcast (among users) [a]	x	x
Adoption of podcasts as an educational resource		
Previous experience with podcast in a course [c]	x	x
Evaluation of using podcasts as an instructional resource [d]	x	x
Preferred type of content for a podcast that is part of a course [b]	x	x
Recommended time extension for a podcast that is part of a course [a]	x	x

Disposition to incorporate podcasts in a course [d]	x	-
Disposition to listen podcasts that are part of a course [d]	-	x
Aspects that will consider in order to develop a podcast for a course [a]	x	-
Aspects that will consider in order to listen podcasts that are part of a course [a]	-	x

[a] Open-ended question
[b] Closed-ended question: Multiple choice or checklist
[c] Closed-ended question: Dichotomous
[d] Close-ended question: Likert scale

Table 3. Students and faculty questionnaires content by section

3.3. Data analysis

Due to the non-inferential nature of the study, descriptive analysis was performed to achieve all the proposed objectives. Frequency and crosstab tables were used to explore and detail each variable. Comparisons between faculty and students' responses were emphasized in order to ascertain the direction of results for both groups in terms of knowledge and use of technology, particularly the adoption of digital audio files (i.e., podcasts) as an instructional device. Data was organized and analyzed using IBM® SPSS® Statistics 25.

4. Results

As shown in tables 1 and 2, three-fourths of students (77.2%) and nearly two-thirds of faculty members (63.2%) were female. Student's average age was 29.3, where the highest percentage of students belongs to the age range of 20 to 24 years (32.2%); however, the majority of students (55.7%) are from what is considered in the educational literature as the non-traditional age group (i.e., 25 years or older). Most of the students (60.4%) reported that they were pursuing a bachelor's degree at the time of the questionnaire administration and 30.4% were enrolled in a higher-level degree program (i.e., master/doctorate).

In terms of years of experience teaching at the higher education level, faculty members were practically evenly distributed among three categories: "less than 10 years of experience" (35.6%), "10 to 19 years of experience" (36.8%), and "20 years of experience or more" (27.6%). Table 4 shows the distribution of faculty members and students by the academic unit where they teach or are enrolled, respectively. A higher proportion of students (33.8%) are enrolled in non-traditional offerings, which includes adult accelerated programs. This is consistent with the fact that a higher proportion of students in the sample come from the non-traditional age group. The majority (54.0%) of faculty members are affiliated to the Health Sciences and the Social

Sciences, Communications and Education units, while 44.1% of the students were enrolled in programs from these units.

Academic unit	**Faculty members**		**Students**	
	n=87	%	n=447	%
Health Sciences	24	27.6	76	17.0
Social Sciences, Communications and Education	23	26.4	121	27.1
Business and Tourism	18	20.7	72	16.1
Natural Sciences	10	11.5	27	6.0
Other [a]	12	13.8	151	33.8

[a] Includes units with non-traditional offerings (e.g., accelerated, online, and technical studies).

Table 4. Distribution of faculty members and students by academic unit

4.1. Use of technology

In terms of experience with online or hybrid courses, 57.5% of the faculty members and 52.6% of the students informed that they have not offered or taken online or hybrid courses at the time of the administration of the questionnaire. The similarity in the proportion of responses is not surprising because it's dependent on the institution's course programming, which is the same for both groups of participants. Moreover, the answers for the other options showed no substantial differences: around one-fifth of professors (18.4%) and students (22.8%) offered or took online courses; between 17.2% (faculty members) and 15.9% (students) participated in hybrid courses; and less than 10.0% participated of both course modalities (i.e., online or hybrid).

Regarding the use of electronic equipment or devices, faculty members use a laptop (39.1%) slightly more frequently than a standalone computer (31.0%) and a mobile phone (27.6%). Only 2.3% indicated a tablet. By contrast, students use their mobile phones (57.7%) more frequently than laptops (30.9%). Less than 10.0% mentioned a standalone computer (7.4%) or a tablet (4%).

More than half of professors use their preferred electronic equipment or device to "do academic work" (75.9%), "read or write e-mails" (65.5%), or "explore topics of personal interest on the web" (63.2%); and less than half use it to "participate in social networks" (41.4%) or "entertainment activities" (36.8%). Students exhibited a similar pattern in the first categories: 76.1% use it to "read or write e-mails", 73.6% to "explore topics of personal interest on the web", and 69.8% to "do academic work". However, more than half use their preferred electronic equipment or device to "participate in social networks" (63.1%) or "entertainment activities" (58.4%). This could be related to the fact that their most frequently used electronic equipment or device is the mobile phone.

When asked about the use of electronic equipment devices for selected activities (i.e., academic and entertainment activities), the professors prefer the use of a laptop (54.0%) for "academic activities"; but prefer the mobile phone (71.3%) for "entertainment activities". Students also prefer the use of a laptop (64.4%) for their "academic activities" and prefer a mobile phone (87.9%) for their "entertainment activities". Even though the proportions differ in magnitude, both groups provide similar answers that depend upon the specific activity: academic vs. entertainment.

Almost all participants use at least one social network: 96.6% of faculty members and 99.1% of students. Among users, the top four social networks are:

- WhatsApp (90.5% and 97.1% among professors and students, respectively),
- Facebook (81.0% and 87.8% among professors and students, respectively),
- Youtube (78.6% and 77.9% among professors and students, respectively), and
- Instagram (51.2% and 77.9% among professors and students, respectively).

The relatively biggest differences were found in the use of Snapchat, where 44.5% of the students selected it in contrast to 14.3% of the professors and on the contrary, 39.3% of the latter selected Linkdln in comparison to 17.4% of the students. This result responds to the academic nature of this social network.

The majority (60.7%) of faculty members that are social network users dedicated "2 hours or less" daily and only 7.1% reported using it for "more than four hours". By contrast, students spent more time on social networks: 45.1% using their social networks for "2 hours or less" daily, and 22.5% use them for "more than four hours" daily. Additionally, 4.1% expressed that they participated on social networks "all/almost all day" or dedicated "many hours/time". These responses came from students who chose to qualify their answers instead of providing daily hours as requested.

4.2. Knowledge and use of podcasts

Almost two-thirds (64.3%) of faculty members reported knowing "a lot" or "some" about podcasts, in a 4-point Likert scale (a lot, some, little, nothing), and 78.2% reported listening at least a podcast over their lifetime. Of these, 25% "rarely (a few days a year)" or "never" listened to a podcast in the past year. By comparison, students showed a lower level of knowledge and use of podcasts: practically half (51.9%) expressed knowing "a lot" or "some" about podcasts; and 56.2% reported listening to at least a podcast over their lifetime. Of these, 29.1% "rarely (a few days a year)" or "never" listened to a podcast in the past year.

Participants, who reported that they have listened to a podcast at some point and listened to a podcast in the past year, were asked to express how frequently they listened to each of the 19 categories of podcasts similar to those used by iTunes (now Apple podcasts). Level of frequency was measured in a 5-point Likert scale: many times, sometimes, rarely, almost never, and never. The podcast categories mostly heard ("many times" and "sometimes") among faculty members and students are shown in Table 5. The table includes those categories where 40.0% of both (faculty and students) or one of them indicated listening to podcasts related to that type of content. The most popular categories are similar for both groups, except that "comedy" was frequently heard by students and only 19.6% of the faculty members expressed a preference for podcasts with this type of content.

Podcast category [a]	**Faculty members**		**Students**	
	n=61	%	n=229	%
News	35	57.4	110	48.1
Music [b]	31	50.9	110	48.1
Education [b]	31	50.8	101	44.1
Technology	27	44.3	91	39.8
Comedy	12	19.6	107	46.7

[a] Among participants who reported that they have listened to a podcast at some point and also listened to a podcast in the past year.
[b] Differences in the percentage of categories with the same base of responses are due to rounding when merging the top two scales ("many times" and "sometimes").

Table 5. Most frequently listened podcast categories

In terms of their favorite platform to listen to podcasts, the faculty prefers "Spotify" (29.5%), Apple podcast (24.6%), and "Pandora" (23.0%); while students show a stronger preference for "Spotify" (45.4%), followed by Apple podcast (20.5%). The main reasons that participants gave for listening to podcasts were distributed similarly in both groups. The responses were grouped into categories, resulting with the following three in the top categories: "content" (e.g., obtain knowledge, interest on the topic or guest); "mood effects" (e.g., distraction, leisure, entertainment); and "availability" (e.g., I can listen to them while doing other things, I can listen to them everywhere and anytime). Two-thirds (67.3%) of the professors and half (52.2%) of the students mentioned "content", 22.4% of the professors and 37.6% of the students provided answers related to "mood effects" and "availability" was mentioned by 16.3% and 13.2% of faculty members and students, respectively.

The majority of the faculty members (52.0%) and the students (56.3%) tend to listen to their podcasts at home; while others (41.0% of the professors and 31.9% of the students) listen to them while driving. More than two-thirds of the participants (73.8% of faculty members and 66.4% of the students)

consider the "topic or content" of the podcast as its most important attribute in comparison to "audio quality", "time duration", and "people participating in the podcast".

The majority of participants consider that each podcast should last "30 minutes or less" (65.6% of professors and 56.8% of students). Three-fourths of participants have the habit of listening "always" (14.8% of faculty members and 27.9% of students) or "almost always" (59.0% of faculty members and 49.8% of students) to the entire episode of a podcast. The habit of listening to an entire episode of a podcast was evaluated with the following options: "always", "almost always", "sometimes", "almost never", and "never".

4.3. Adoption of podcasts as an instructional resource

When asked about podcast utilization as part of a course, 78.2% of the faculty members reported never using it for this purpose. Still, a similar proportion (73.6%) evaluates its potential use as an instructional resource as "excellent" (35.6%), "very good" (18.4%), or "good" (19.5%). The other options in the scale were "fair", "poor", and "don't know". The students' answers were similar to those of faculty members: 86.6% reported never using it as part of a course; but 69.8% evaluate its potential use as an instructional resource as "excellent" (30.2%), "very good" (20.4%) or "good" (19.2%).

The vast majority of the faculty (74.7%) would like the course podcast content to "address topics related to what was discussed in class", and that they should last "30 minutes or less" (83.9%). On the other hand, 42.7% of the students would like that the course podcast content "address topics related to what was discussed in class"; but a similar proportion (42.3%) would prefer that the content "reproduce everything discussed in class". As for the podcast extension, they also think it should last "30 minutes or less" (64.7%).

When asked about their disposition to incorporate podcasts into their courses, the faculty reported "being in the disposition to develop podcasts for their courses" (47.1%), or "being in the disposition of incorporating both podcasts, developed by the faculty member or developed by other people, into their "courses" (32.2%). The incorporation of these podcasts into their courses would depend on the "availability of resources" (38.8%), "knowledge on how to develop a podcast" (38.8%) and "time availability" (27.5%).

On the other hand, when asked about their disposition to listen to podcasts as part of their courses, the students reported that they "would definitely listen to them" (52.1%), or "very possibly listen to them" (34.0%). Listening to these podcasts, as part of their courses, would depend on the "topic or content" (29.5%); if it "helps as a review for the course content" (11.7%); or if it is "fun, entertaining, or interesting" (10.4%).

5. Discussion

Questionnaires, both faculty and student versions, were sent just before the COVID-19 outbreak in Puerto Rico. Some of the follow-up reminders were not sent to the participants due to the consequent compulsory lockdown. This could have affected faculty members and students' participation in the study and therefore final sample size.

In terms of the characteristics of the sample, the main findings were that more than half of the students are from the non-traditional age group, and nearly one-third was pursuing a higher-level degree program. In terms of age, the student participation was unexpected. It is almost exactly the opposite of the distribution in the institution's population, where 54.0% of the students are from the traditional age group (i.e., under 25 years of age). In general, this implies that most students come from an older segment, which could be closer to the technology usage patterns by faculty members.

When administering the questionnaire, more than half of the participants indicated that they had not offered or taken online or hybrid courses. This is consistent with findings from the *2019 Survey of Faculty Attitudes on Technology* (Jaschik & Lederman, 2019) and students' participation in distance education courses in Fall 2018 (Hussar et al., 2020). It should be noted that Puerto Rico is part of the US higher education system. After the pandemic, participation in instructional formats changed since all the courses began to be offered remotely, having unexpected effects on traditional instructional processes (Fox et al., 2020; Tejedor et al., 2021).

The use of technological equipment and devices, both by the faculty and the students, varies according to their purpose (e.g., academic, entertainment activities). In general, students tend to associate the mobile phone with entertainment activities, precisely making this an ideal device for incorporating podcasts as an instructional resource due to its versatility and familiarity with its features (e.g., portability). Although mobile use as an instructional resource could have changed because of the educational strategies adopted after the COVID-19 outbreak.

As expected, almost all participants use at least one social network. This is consistent with the information provided by The Infinite Dial report (Edison Research, 2021), which establishes that the use of social networks is already widespread. Two of the most used social networks of our sample coincide with The Infinite Dial report, the Social Media Use in 2021 report (Pew Research Center, 2021), and the Encuesta Pod 2019: Un estudio para conocer a las audiencias de podcast en español (Podcaster@s 2019): Facebook and Instagram. However, WhatsApp was the most mentioned among our participants, but according to *The Infinite Dial* and the *Social Media Use in 2021*, only one-fifth use this social network in the US. Even when compared

by age groups, WhatsApp users in our study are very different from those reported in the *The Infinite Dial*.

Nevertheless, WhatsApp is the most used social network—more than 75%—among the Latin American community, according to the *Encuesta Pod 2019 (Podcaster@s 2019)* survey. This coincides with the Social Media Use in 2021 report (Pew Research Center, 2021), which states that "Hispanic Americans (46%) are far more likely to say they use WhatsApp than Black (23%) or White Americans (16%)" (p. 6). Social media preferences may be related to cultural differences.

Students reported using Snapchat much more than faculty members. This finding is expected if you compare it with the US usage of this social network based on age. The age group that mostly uses Snapchat is adults under 34 years (Pew Research Center, 2021; Edison Research, 2021). The majority (60.7%) of faculty members that are social network users dedicated "2 hours or less" daily in comparison to 45.1% of the students who are social network users. As expected, students use more frequently this digital media during the day.

During the last 15 years, familiarity with podcasts has more than tripled in the US, growing from 22% in 2006 to 78% in 2021 (Edison Research, 2021). In our case, almost two-thirds (64.3%) of faculty members and half (51.9%) of students reported knowing "a lot" or "some" about podcasts. If we take these percentages as an indicator of familiarity, it may be argued that they are not as high as the findings in US for 2021 but are comparable to those within five years ago: 55% in 2016 and 64% in 2018.

Students reported a very similar percentage of listening to a podcast at least one time in their lifetime (56.2%) when compared with the participants of the *The Infinity Dial* report (57%). Still, faculty reported a much higher percentage (78.2%). This finding could be related to the fact that profile of frequent podcast consumers is related to higher levels of education and full-time employment (Edison Research, 2019).

Two of the top five Podcast categories most frequently listened by our sample are included in the top five of the *Encuesta Pod 2019* (*Podcaster@*s, 2019) survey: *news* and *technology*. *News/information* is the second preferred topic in US (Edison Research, 2019). The fact that our sample has chosen *education* as one of the most listened podcast categories should not be surprising, since this sample comes from a higher education setting, and in some way can be related to topics such as *news* and *information* because of the intention of being knowledgeable about something. But the main difference, in terms of podcasts categories, was that students preferred *comedy* compared with faculty members.

Both faculty and students prefer *Spotify* as their platform to listen to podcasts, which is consistent with findings from *The Podcast Consumer* (Edison Research, 2019) and *Encuesta Pod 2019* (*Podcaster@*s, 2019). In

fact, this latter survey establishes that the arrival of Spotify was key to the expansion of podcast listening in Latin America. Apple podcast is the second preferred platform among our sample participants. Pandora is mentioned by the faculty as their third option, very close to Apple podcast. Selection of a podcast hosting platform in a university is straightforward because the obvious option is the learning management system used to deliver non-face-to-face instruction; an important feature to take into consideration is the capacity of the system to add RSS feeds into the course.

The reasons given by our sample for listening to podcasts were similar to what has been found in other surveys (Edison Research, 2019; *Podcaster@*s, 2019). Our sample responses were grouped in the following categories, in order of importance: (a) *content* (e.g., obtain knowledge, interest on the topic or guest), (b) *mood effects* (e.g., distraction, leisure, entertainment), and (c) *availability* (e.g., I can listen to them while doing other things, I can listen to them everywhere and anytime). To "learn new things" is also the top answer—around 75%—of podcast users as reported by the *The Podcast Consumer* (Edison Research, 2019) and *Encuesta Pod 2019* (Podcaster@s, 2019). The fact that podcast users highlight the educational attribute of this digital media makes it an ideal formal instructional resource. In this case, the main challenge is to turn non-users into educational podcast consumers. The other podcast attribute that is also mentioned in large-scale surveys is that it can be available at any moment and that it can be listened to while doing other things.

Although podcast use has seen a dramatic growth in the last decade in the US (Edison Research, 2021), and its incorporation as an educational resource was relatively quick, this growth in Puerto Rico is fairly recent, and as an educational resource is basically unknown. Based on the results of our study, there would seem to be good conditions to explore the use of podcasts as an instructional resource, with students and faculty members evaluating this possibility positively. This tends to agree with the literature review, which establishes that students perceive podcasts as a useful tool to support learning but their faculty does not make them available (Kennette & Wilson, 2019; Pinto & Leite, 2020, p. 348); and most faculty members report not using podcasts in courses but thinking it can be useful in helping students learn (Kennette & Wilson, 2019). The majority of faculty members who participated in our study argue that the adoption of podcasts is mainly a matter of work conditions (e.g., resources, time, benefits) and technological competencies (e.g., knowledge on how to develop a podcast).

According to the majority of both faculty members and students participating in the study, instructional podcasts should have a length of 30 minutes or less. This is consistent with other studies that recommend 5 to 15 minutes, followed by 15 to 30 minutes (Cosimini, Cho, Liley, & Espinoza, 2017). In terms of content, the majority of the participants in our study

consider that the podcasts should address topics related to what was discussed in class, but a considerable proportion of students are also open to content that "reproduces everything discussed in class". Both alternatives are viable and have been used in education, but some consider the latter as a "poor example of a podcast" and not the best practice in education (Palenque, 2016, p. 5).

A more effective educational podcast is aligned with the first alternative selected by the majority of our participants. Instead of recording the whole lecture, it is a better practice to: break the class material into single concept blocks, establish a separate learning objective for each, and supplement each block with related examples (Palenque, 2016, p. 5). In addition to content or the usefulness of the educational podcast, students consider that it should also be entertaining or interesting.

6. Conclusions

The COVID-19 pandemic has had, as in many aspects of our daily living, a significant impact on the instructional delivery format. Emergency remote teaching became the format followed by postsecondary institutions in many national contexts implemented to continue providing educational services. This situation meant an abrupt disruption of a trend that began years ago of adopting digital technologies (e.g., video conferencing, discussion boards, blogs, wikis, MOOCs, mobile learning, social media, podcast) in the instructional process. Emergency remote teaching did not necessarily mean a qualitative leap in incorporating those digital technologies because it did not follow a well-planned process. As a result, the creation of educational content is relevant no matter the instructional format.

Podcasts are an excellent digital technology that has acquired an extraordinary acceptance in the general public and has been translated into formal education settings. Two main attributes are associated with podcasts: (a) source of obtaining information or learning and (b) versatility and flexibility in terms of usage. These features support the idea of its adoption as an instructional resource. As evidenced by students' perception, podcast adoption as an educational resource depends on content, length, usefulness, and entertaining value. On the other hand, podcast acceptance by faculty members depends heavily on working conditions and technological competencies.

The findings of our study are a significant contribution to the area of educational technology, presenting an overview of the use of technology and potential adoption of podcasts among members of a community of higher education in Puerto Rico. Although the findings are limited to this scenario due to the non-inferential approach, the selection of the case study as a research design allowed us to have an initial empirical exploration on the topic. This serves as a benchmark and catalyst for investigating podcast

adoption and use through more complex research designs and in different educational settings.

For future studies, we recommend: (a) the integration of qualitative [e.g., focus groups] or mixed methods techniques to delve into topics such as podcast adoption issues in educational processes; (b) the exploration of the potential impact of the pandemic in podcast adoption among the members of different higher education institutions around the world; (c) the administration of an instrument that measures podcast technology adoption; (d) identifying the specific podcasts used in the higher education setting [e.g., self-created by faculty or students or podcasts available through a podcast hosting platform created by other people] and how they were used [e.g., as supplemental material or reproduce course content]; (e) a study with an experimental or quasi-experimental design that can measure the effects of an educational intervention that includes podcasts; and (f) international comparative studies of podcast adoption and effectiveness as an instructional resource after the COVID-19 outbreak.

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