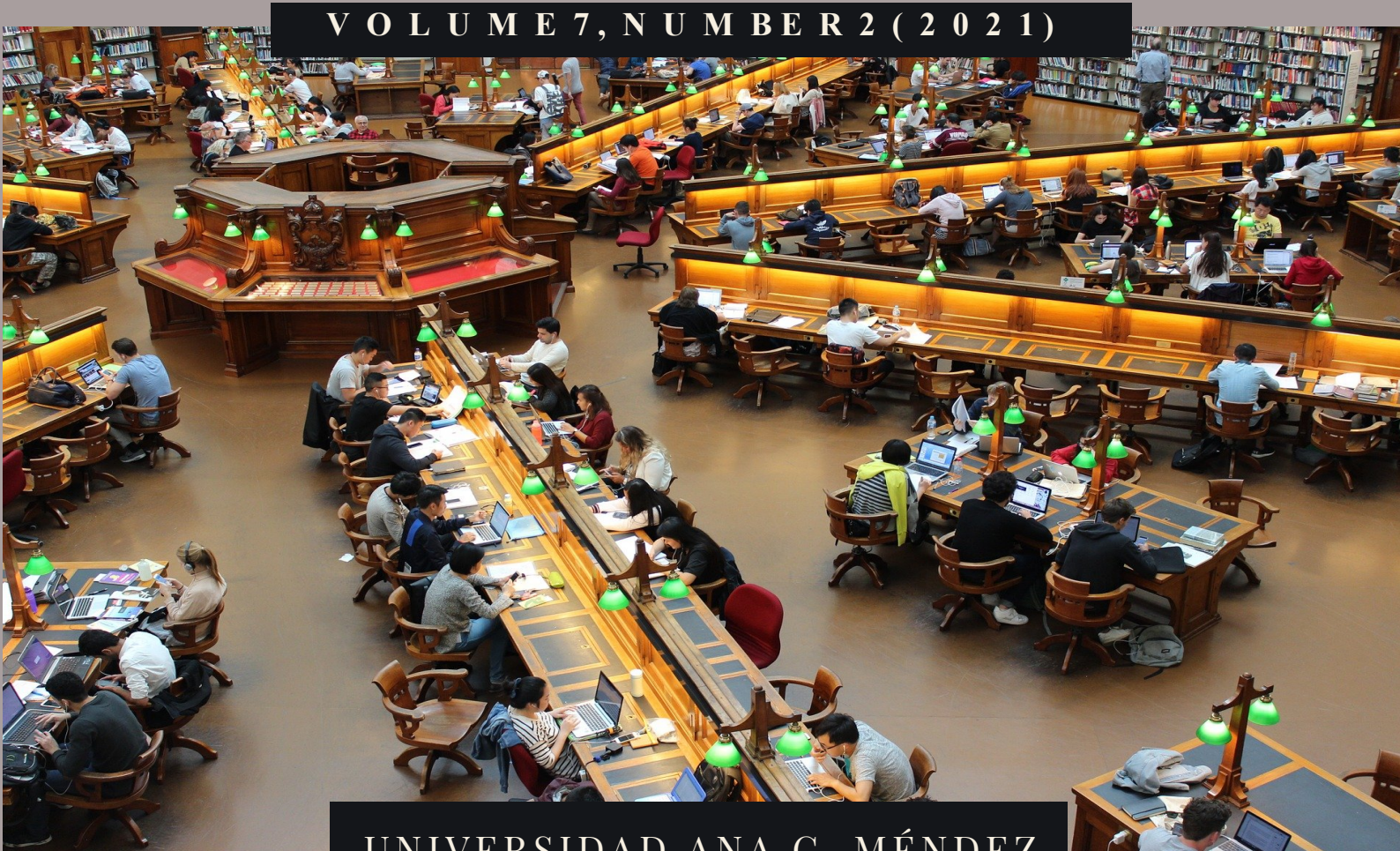


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Escuela de Educación, PO Box 21150 San Juan, PR 00928-1150

Editor-in-Chief: **José Gómez Galán**

International Journal of Educational Excellence

DESCRIPTION

The *International Journal of Educational Excellence* (ISSN 2373-5929) is a multidisciplinary scientific journal which main objective is the dissemination of studies that provide answers to the main educational scientific and social problems present in higher education, in order to achieve excellence quality in all their areas. Papers will be welcomed, regardless of the subject area to which they belong as long as they entailed a contribution, innovation or breakthrough in the development of models of teaching or scientific research in the scientific world which lead to a social improvement. Research work performed in other educational levels may also be considered, if they demonstrate a strong and justified relationship to higher education. All papers submitted for publication must be unpublished and originals, and should not be under any evaluation procedure for publication in other journals. Theoretical work as well as work based on field studies and empirical laboratory experiments are accepted. All kinds of strategies and methodological approaches may have been used for the study. They have to comply within the parameters of current scientific and technological research. The review criteria and selection process will take into account mainly the quality of the work under consideration: if it makes a significant contribution to the object of interest, main interests of the journal and if it offers a breakthrough or significant contribution to the current scientific knowledge and, ultimately, if it contributes to the progress of our society. This journal is of free and direct access (Open Access, OA), and it serves the international scientific community and open knowledge.

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PEER REVIEW PROCESS

Original submissions to the *International Journal of Educational Excellence* (IJEE) will be reviewed by external referees, a process known as peer review. Reviewers are academics and researchers who are experts in the corresponding specialized field of knowledge. Their main task will be to study all submitted papers critically and constructively. For a paper's evaluation a "double-blind" system will be used. This method consists of one in which authors and reviewers are not known to each other, aiming at a maximum objectivity in the evaluation of the manuscript. Those articles that are considered by the editorial and scientific committee of the journal with high possibilities for publication will be submitted to referees who will determine the relevance of their acceptance. It may be the case that they be sent back to the authors with suggested changes and then back again to the journal to continue with the evaluation process, which ultimately will assess the relevance of the article to be published or rejected.

JOURNAL FREQUENCY

The periodicity of the *International Journal of Educational Excellence* will be two issues per year, and these will form a volume. The first issue is published in the first half of the year, the second issue in the second half. There is no deadline for the submission of manuscripts, which will remain open during the whole year and publication of the

article will possibly appear in the following issue after a positive evaluation of the work. For monographs, in which contributions to a specific topic will be requested, the deadline for receipt of manuscripts for evaluation corresponds to June 30 for the first issue and December 31 for the second issue, both referred to volume of the year following the call of articles.

IDENTIFICATION AND ACCESS TO THE JOURNAL

The journal is named *International Journal of Educational Excellence*, and it is abbreviated IJEE. Its ISSN (International Standard Serial Number) number is 2373-5929. For cataloging, it should be referred to as International Journal of Educational Excellence (IJEE): ISSN 2373-5929. Access to the journal may be performed from the main web address: http://www.suagm.edu/umet/oa_pe_edu_ijee.asp

AUDIENCE

The journal is addressed to the scientific community and to the general to society as well. However, because of its own nature, the principal target audience should be: university professors, scientists, researchers, managers of higher education, social and political workers within the fields of education and science and others related.

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ETHICS

For all parties involved in the act of publishing (the author, the journal/publisher and the peer reviewer) it is necessary to agree upon standards of expected ethical behavior. The ethics statements for the International Journal of Educational Excellence (IJEE) are based on the Committee on Publication Ethics (COPE) Editors (www.publicationethics.org).

The value of scientific publishing relies on everyone involved behaving ethically. The publication of an article in the International Journal of Educational Excellence, a peer-reviewed journal, is a direct manifestation of the quality of work of the author and the institutions that support them. Peer-reviewed articles support and embody the scientific method. Ethics topics to consider: Authorship: Authorship should be limited to those who have made a significant contribution to the reported work. The authors should ensure that their study is original and written by them and their work has not been previously published and has been submitted only to the journal. / Originality: The authors should ensure that where material is taken from other sources (including their own published writing) the source is clearly cited and that where appropriate permission is obtained. / Data access: Authors may be asked to provide the raw data in connection with a manuscript for editorial review, and should be prepared to provide public access to such data. / Acknowledgement of sources: Proper acknowledgment. / Conflicts of interest: The authors should ensure that any real or apparent conflicting or competing interest is clearly stated on submission of their manuscript. / Reporting standards: Authors of reports of original research should present an accurate account of the work performed. / Human or animal subjects: The authors should ensure that they adhere to all research ethics. / Confidentiality and impartiality of the reviewers: The reviewers must maintain the confidentiality of the review process and conduct themselves fairly and impartially; immediately alert the editor-in-chief of any real or potential competing interest that could affect the impartiality of their reviewing and decline to review where appropriate.

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1. Introduction

The *International Journal of Educational Excellence* (IJEE) is open to all scientific articles which provide answers to the main educational and scientific problems currently impacting higher education with the purpose of achieving quality excellence in all areas. Papers will be welcome, regardless of the subject area to which they belong, as long as they entail a contribution, innovation or breakthrough in the development of models for teaching or scientific research within the university environment leading towards social improvement. Research work performed in other educational levels may be also taken into account, as well as they provide an adequate justification and a valid relationship with higher education issues.

All papers submitted for publication must be unpublished and original, and should not be under evaluation for publication in other journals. Theoretical work as well as those based on field studies and empirical laboratory experiments contributions, are accepted. All kinds of strategies and methodological approaches may be employed; however the selected method for each research has to be in compliance within the parameters of current scientific and technological research. The review criteria and selection process will mainly assessed the quality of the work under consideration in terms of the following criteria: significant contribution to the object of interest of the journal, a breakthrough to the current scientific knowledge and, ultimately, the contribution to the progress of our society.

2. Details for Submission

Manuscripts should be sent preferably sent in digital format. All manuscripts should be addressed to the journal Editor-in-Chief (email: jogomez@suagm.edu). Prior to submission, publishing standards should be carefully read at the following web site http://www.suagm.edu/umet/oa_pe_edu_ijee.asp. Only those articles that meet all the requirements and characteristics described at the web site will be accepted.

Submission of original digital file will preferably be in RTF format. The .ODF format is also accepted. Other formats (such as DOC, .PDF, etc.) are excluded.

In the rare event that the author (s) of an article cannot submit manuscripts electronically, the article shall be traditionally mailed. However, it should include a copy of the article in the previously outlined digital formats. Manuscripts will be sent by postal mail to the following address: International Journal of Educational Excellence (IJEE), Escuela de Educación, Universidad Ana G. Méndez (UAGM), Recinto de Cupey, PO Box 21150 San Juan, Puerto Rico, 00928-1150. The attention should be directed to: Editor in Chief.

3. Authorship and Responsibility

The author (s) of the article should submit one copy of the original article and a statement certifying that the work is original and has not been published before and that it has not been evaluated by another journal editorial committee.

The author (s) must also declare that [a] all named authors have materially participated in the development of the research or study that has led to the article, [b] any conflict(s) of interest, and [c] the sources of funding of research presented in the article or of the preparation of the research.

They shall also explicitly accept the journal rules of publication and the decision regarding the publication or rejection of an article. The *International Journal of Educational Excellence* (IJEE) assesses and requires all high international standards of ethical conduct of research and journal publication.

4. Preparation of Manuscripts

Articles should be submitted in proper English (British or American, however, but a mixture of both will not be allowed), whose length will be at least 3500 words and a maximum of 12,000, including references, notes, tables and figures. Exceeding this amount of words will be a major negative factor in evaluating the article, although articles exceeding this extension can be exceptionally published if they are properly justified and the work stands out for its quality.

The article must be preceded by an abstract thereof with a minimum of 150 and a maximum of 300 words. It must also be submitted in English language along with Spanish and Portuguese translated versions. The summary should also include five to seven key words in English, Spanish and Portuguese.

Articles of theoretical nature as well as those based on field studies will be accepted, and they will be considered as a positive evaluation element if those articles maintain the classical structure in scientific research papers, consisting of separate sections and subsections (eg. Introduction, Objectives, Methodology, Analysis, Results, Discussion, Conclusions, Appendices and Annexes, etc.). However, freedom is offered to the authors to establish the most appropriate structure, depending on the nature and characteristics of their research (and is especially significant in the case of theoretical articles). What is required in all cases is that the division of the article be clearly defined and numbered by the structure 1 (with 1.1, if 1.1.1, 1.1.2, etc.), 2, 3, etc. Each title and subtitle of the sections and subsections should be clearly identified through the use of spaces.

Standards of quotation, including references, must be governed by the style of the APA (American Psychological Association), contained in the *Publication Manual of the American Psychological Association*. Please see the following examples which are explained within the next paragraph:

Citations to text:

Whenever there is a quote of the author or authors of a publication, it should appear in the text in parenthesis followed by the year -for example if a single author is cited (Smith, 2014), if the citation refers to two to five authors (Smith & Brown, 2011 / Smith, Brown & Torrero, 2009), or if there are more than six authors (Smith et al, 2014) - and the full reference will appear in the list of references at the end of the article. If two or more works are cited, they will appear in the same order in the reference list separated by a semicolon (James, 2001, Smith, 2014). If in the article two or more references by the same author published in the same year are cited, they should be differentiated by lowercase letters (a, b, c, d, etc.) added to the year; in the text quote, the corresponding lower case letter will be used in each specific reference (Smith, 2014a).

If the citation refers to a general idea of the work, or if it is a general reference to an article, book or full investigation, but is not literally quoting a portion of the reference, it is only necessary to refer to the author and year of publication, without specifying the page intervals.

If the citation is literally quoting a text from a specific work, the author, year of publication and the page intervals should be entered preceded by "p" for example, according to Smith (2014) "the university teachers with many teaching hours have difficulty in carrying out research work" (p. 379), / in his study he argued that "university teachers with many teaching hours have difficulty in carrying out research work" (Smith, 2014, p. 379) but the author did not show the statistical analysis of the survey results.

In case the direct quotations exceed 40 words it is necessary to set up them within a separate text block, and quotation marks are omitted. It is recommended to begin the quotation on a new line with a tab on the left margin

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of ½ inch or 1.25 cm, maintaining this margin along the length of the cite. Page intervals should be indicated as described in the preceding paragraph.

Sometimes, in the work, it may be necessary to refer to indirect quotations, i.e. presenting information or ideas of an author who has been picked up and quoted by some other one. In this case, the two authors are cited; starting with the indirect reference, for example, Brown (cited by Smith, 2014, p. 179) suggests that research is essential in university teaching. It is also recommended to find out and cite the original source.

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The list of references should appear at end of the article. With this information, the reader may access any of the sources that have been cited in the main body of the work. Each and every one of the sources cited should appear in the reference list. Similarly, each of the references that appear in this list should appear in the main text of the article at some point.

The references list appears at the end of main body of article, and after two spaces, using the title "References", with the same format as each of the subtitles that make up the work. All lines subsequent to the first line of each entry in the reference list should be indented ½ inch or 1.25 cm. The names of the authors appear inverted (last name then first initial or initials of the first names). The entries in the reference list should be ordered alphabetically according to the first author of each work. If several works by the same author have been cited, these entries should also be collected in chronological order, starting from oldest to the most recent. The full title of the work should be provided, keeping the title used by the publication. Capitalization of all major words of journal titles is recommended.

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At present, the rules of APA citation are widespread in the field of social research, and its style is the most currently used to cite sources in this area. Therefore in case of any doubt regarding citations, we recommend consulting the *Publication Manual of the American Psychological Association* (6th edition), where it multiple examples of formats of research papers, text citations, footnotes, references, etc. can be found; here we have offered only general guidelines.

General Format of Manuscripts:

The manuscript should follow the general format not only meeting the scientific requirements requested by this journal but also identifying the best possible characteristics of the article. Submission the manuscript in digital format, or RTF .odf, double-spaced in a standard size paper (8.5 "x 11") or A4 (21 x 29.7 cm) 1 "(or 2 cm) margins, is recommended. Although any easily readable source may be used, the use of Times New Roman 12 point is recommended. The manuscript should include a header at the beginning of the page, providing the main scientific information of the author and the work. These data are:

Title: should be as concise as possible, reporting the content of the article. It should be taken into account that quite often titles are used by scientific database systems and information retrieval, so it is advisable that it contain words directly related to the content of work. It must not contain abbreviations or acronyms that are not widely known. The title should be centered as the first element of the header. The APA recommends that it does not exceed 12 words in length, but if it were required by the nature of the work, it shall not prevent the acceptance of the manuscript.

Name of author (s) and affiliation: should appear in full below the title, separated by a double space using the following format: First Name, Middle Initial (if applicable) and last name (both names if Latin American author (s). Titles (Dr.) or degrees (PhD) may not be used. In order to allow the precise localization of the institution where the research was performed, its full address should appear below the name of each author (City, country, zip code). Finally, below the institution's address, the e-mail of each author should appear.

Mailing address of the corresponding author: In addition to email, full address for correspondence is recommended but not mandatory (telephone numbers, country and local codes). It may appear as a footnote.

Abstract: It should be placed after the name, affiliation and email address of the corresponding author separated by double space. As indicated above, it should have a length between 150 and 300 words. It will be sent in English, Spanish and Portuguese and should summarize the main features of the research work (as a minimum it is advisable to include a summary of the objectives, methodology and results, especially if it is based on fieldwork research). Future research may be included, especially if it has given rise to different questions that invite subsequent effort.

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Keywords: will be entered below the summary separated by a double space. We recommend providing five to seven key words that identify the work more precisely, and may help other researchers to find it in the international databases. The keywords will be sent in English, Spanish and Portuguese, and for their selection it is advisable to use the thesaurus most used in the specialty.

Article: Below the keywords, the author will placed the main body of the text submitted for publication in the International Journal of Educational Excellence (IJEE), in accordance with the recommendations given in this Guide for Authors.

Scientific and professional record of author (s): Placed below the main body of the manuscript leaving three lines and as the last element of the manuscript to be submitted. The scientific and professional background of each author should not be longer than 300 words, specifying recent published papers.

Notwithstanding the guidelines outlined above, it is strongly recommended for preparing manuscripts, to follow the APA style compiled in *Publication Manual of the American Psychological Association* (6th edition).

5. Publication of Articles

Submission of a manuscript to the *International Journal of Educational Excellence* (IJEE), implies a previous statement by the authors that the work submitted to the journal is original and unpublished, that it has been the result of the authors' work, that all the signatories have materially participated in its preparation, and that the manuscript is not under evaluation for publication elsewhere, whatever the media, especially that it is not under evaluation by other scientific journals. All journal rules are also accepted, as well as final the opinion resulting from the academic evaluation of Article whether it is accepted or rejected for publication.

The editorial staff of the *International Journal of Educational Excellence* (IJEE) is not responsible for the opinions, analysis, or results collected by the authors in their articles. It is also assumed that all material in articles are free of copyright rights and therefore it is not responsible for any disputes or claims related to intellectual property rights, which are the sole responsibility of the authors.

The decision to accept or reject the publication of the manuscript will be notified within a maximum period of four months. The notification will be sent electronically (e-mail) to the corresponding author. If accepted for publication, the paper will appear in the next volume of the journal.

The articles published in the *International Journal of Educational Excellence* (IJEE) are digitally edited and will retained all the characteristics of those published in traditional print journals. The articles appear in PDF format, conveniently typeset and numbered as classical journals. Therefore, in this sense the editors facilitate their distribution of the journal and articles and the scientific citation or its contents according to all current standards, making available to the scientific community, valuable contributions resulting from the research. We can say, that in general, this is a publication that takes advantage of all the benefits that ICT offers for easy editing and distribution, considering also the ecological side of publishing without paper. This means that only those parts that are needed should be printed if the case arises. In addition, the digital format of the articles of the *International Journal of Educational Excellence* (IJEE) is adapted to the new computer and telematics tools used in scientific and academic contexts, easily allowing information searching, online and bases data indexing, etc. Access to the content of the *International Journal of Educational Excellence* (IJEE) is free, thereby contributing to the globalization of science and culture.

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Artistic Teaching and Creative Thinking in University Contexts: Analysis of Research Trends

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Abstract: The education sector faces complex transformations. Encouraging artistic teaching and creative thinking in higher education allows increasing the student's collaborative, autonomous, and self-critical capacities. The study's objective is to identify scientific publications related to the teaching of Art Education and creative thinking in university contexts. The study analyzed the evolution of world research on this topic in the period 1969-2019. A bibliometric analysis of 913 articles was performed. The analysis results revealed that scientific productivity has increased since 2015, with the primary category being Social Sciences and Arts and Humanities. Six lines of research related to: creativity, university, visual culture, arts, perception, and sustainability were identified. It is found that the research topic has a growing and dynamic interest in the scientific activity at an international level. This study supposes an analysis of the scientific production and of the actors that energize the research and identify the research lines. The study documented a rapidly growing knowledge base, written mainly by academics located in developed societies..

Key-words: artistic education; visual thinking; ICT; higher education; educational research.

1. Introduction

Education is immersed in increasingly complex challenges. The current society exposed to constant challenges of various kinds: social, environmental, political, technological, economic, and ethical; it requires training that adapts to the new scenarios of the 21st century. In this sense, the University, as a fundamental pillar of economic and social development, must

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contribute to the common good of citizens. Supporting students and future professionals to prosper personally and professionally is one of its fundamental objectives, thus promoting the constitution of stable families and communities (Davies, Fidler & Gorbis, 2011).

In this context, the competency assessment introduced in 2010 with the Bologna Plan and the European Higher Education Area (EHEA) seeks among its objectives the methodological renewal at the didactic level, fostering the development and application of new methodological models by university teachers; Information and Communication Technologies (ICT) being one of the central axes of many of these proposals.

Another of its primary axes consists of bringing education closer to work practice (Larson & Miller, 2011), developing skills and capacities required in this changing current world. Promoting harmonious continuity between present and future requires preparing students for this purpose. That is, to train students with a holistic educational approach that allows them to enhance their skills and abilities.

Since its origin, man has had the need to express himself through drawings, with graphic and visual expression constituting an essential element in his development and evolution, serving as a source, medium and form of expression. Thus, art arises as part of the tangible and intangible culture of the peoples, which in addition to its social role serves as an instrument for those who belong to it. Art allows the expression of ideas, emotions, perceptions sensations (Efland, 1990). This is where its usefulness resides and one of its ultimate purposes is also manifested as an interaction tool, allowing people to activate their senses, making known the perceptions that the environment generates in them and being able to express them together with their feelings, sensitizing the mind and the body with the world (Vigotsky, 2003).

Nowadays, one of the key skills to develop in university students to face challenges and progress in the complex present context is to foster creativity and creative thinking. Rethinking the training of future professionals requires developing new capacities such as resilience and adaptation.

Visual thinking is an educational tool that can help young university students to face the future, fuelling effective communication (Hailey, 2014). The communication skills acquired act as a competitive advantage over other students who have not developed them during their academic process. Studies focused on the academic effects of learning based on artistic and visual development have shown to have an impact on character acuity, motivation, increased social interactions and greater responsiveness to conflicts (Hetland, 2013; Niu & Sternberg, 2003).

Although today's society is focused on approaching knowledge considering reason and scientific thought, the emotional and social aspects of the individual should not be overlooked, which will be those that provide the sensitivity to understand reality, communicate experiences and express

feelings. From this general perspective, artistic expression is an effective way of expressing feelings and experiences, while it represents an educational opportunity for personal and social development (Van de Kamp et al., 2015).

Educating in creativity is educating a skill essential for the cognitive development of the student. In this way, it is possible to form confident, original, flexible, and initiative individuals. Educating in creativity offers an innovative tool to possible changes, since by creating it is possible to evolve and improve educational quality (Craft, 2001).

Art can connect and engage feelings, emotions, and affections, intensely humanizing the student. In this sense, and under the umbrella of the diversity in which we find ourselves, art admits everyone, strengthening self-discovery, and a more affective and effective inclusion in the community environment, this being one of the purposes of expression artistic, becoming a tool for integration (González-Zamar et al., 2020).

In 2010, UNESCO celebrates the II World Conference on Arts Education in which a series of objectives were set for the development of Arts Education. The established guidelines highlight the conviction of the Member States that Art Education must play a fundamental role in the transformation of education systems. To do this, they focused on highlighting three aspects as their goal. The first, to develop the creative thinking of the individual. The second objective seeks to recognize the empowering capacity of Art Education when it comes to valuing and preserving cultural identity and heritage. Finally, the third objective seeks to promote social and environmental responsibility in individuals (UNESCO, 2010).

Therefore, the main objective of this study is to analyse research trends on the implications of artistic teaching and creative thinking in higher education, to elucidate the trends of its application.

To obtain responses to the research questions, a sample of 913 articles extracted from the Scopus database, from 1969 to 2019, has been analysed. This review uses the bibliometric method to synthesize the knowledge base on research in artistic teaching and creative thinking in university contexts. The results show the publications on this subject, thus allowing to identify the main driving agents and trends in this field of research. In this way, this work provides and suggests themes and questions for future research.

2. Methodology

This work aims to analyse research trends on the implications of artistic teaching, creative thinking, and visual learning in higher education, from 1969 to 2019. For this purpose, mathematical, statistical, and mapping tools have been used. Bibliometric is defined as the application of mathematical and statistical methods to journals, books, and other media (Osareh, 1996). The purpose of this methodology is to identify and analyse the main elements

found in a specific field of research. Likewise, it is intended to inquire about the evolution that the subject of study has had and the interest it has aroused, by pointing out the most relevant authors, countries, journals, and keywords in recent years (Guerrero-Baena et al., 2014; Vinkler, 2010).

The research works of a scientific discipline can be classified through bibliographic analysis according to their information, such as the sum of documents, number of citations, number of references used, keywords, organizations, countries, authors, h-index, among others (Abad-Segura & González-Zamar, 2019).

The search string used included the following terms that combine the production of this research field, in English: "artistic", "artistic education", "creativity", "arts visual", "visual thinking" and "higher education". The choice of search terms attends to those with the highest descriptive value and representativeness, according to the literature review carried out. Consequently, the title, abstract and keywords fields are included. The temporal coverage corresponds to the period from the beginning of the first publication (1969) to 2019, that is, 50 years. The initial sample included 913 articles, with a wide diversity of variables to be analysed for each registry. The journal where it is published, the year, the area of knowledge, the author and co-authors of the publication, the institutions, and countries of affiliation of the authors and the keywords that define the document and have originated successful publications have been considered (Abad-Segura et al., 2020).

Using bibliometric techniques, bibliographic maps can be created, viewed, and explored. In these, the links show the connections between the different elements. This work shows the links based on the methods of co-authorship, for authors, organizations, and countries, and of co-occurrence, for keywords. Therefore, the links and the articles form a joint bibliographic network (Leydesdorff & Vaughan, 2006). To analyse and visualize the scientific literature, the VOSviewer software tool was used (Van Eck & Waltman, 2010).

3. Results and Discussion

3.1. Analysis of Scientific Production

This section presents and discusses the main results of the evolution of scientific production in a global context on artistic teaching and creative thinking in university environments.

Figure 1 shows the evolution of scientific production at a global level in the field of research on artistic teaching and creative thinking in university contexts, in the period 1969-2019. It is observed that, of the 913 contributions in the 50-year period studied, 499 have been published in the last 5 years (2015-2019), that is, 54.65% of the total documents, confirming the interest in the subject of research in recent years. In the last year, 2019, 157 articles

(17.20%) have been published. Thus, interest in studying this area of research is manifested at an international level, with a growing publication since the beginning and exponentially with the beginning of the new century. The documents analysed have been written in 21 different languages, with 826 in English (90.47%).

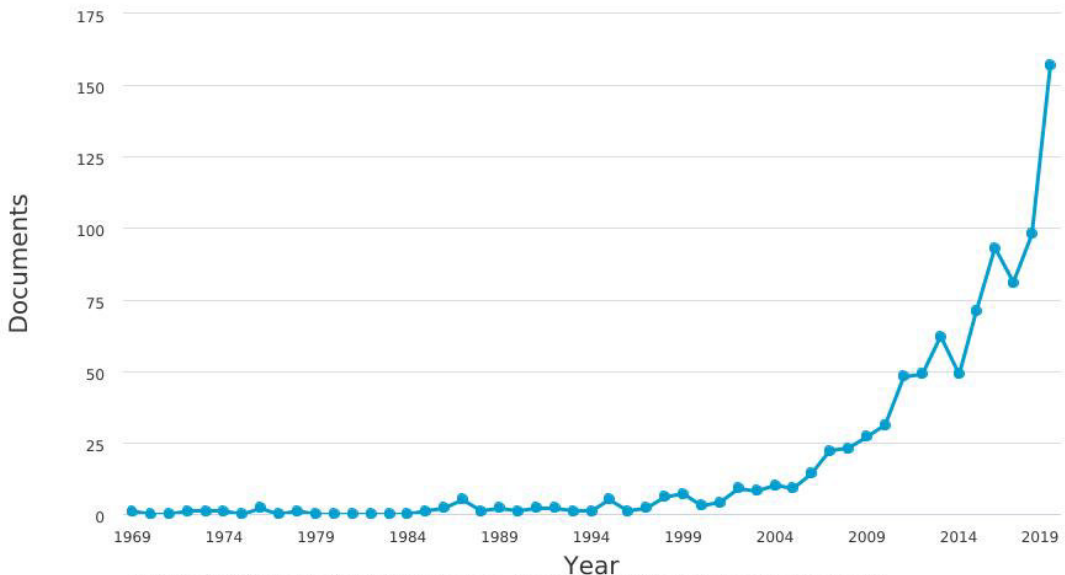


Figure 1. Evolution of scientific production (1969-2019) Source: Scopus

The first article dates from 1969, with the title “Creative responses to higher education of the future, published in the journal *Nursing Outlook*”, by the author Mayhew, L.B. Likewise, the most cited article, published in 2011 by *Higher Education* journal, is entitled “Higher education in East Asia and Singapore: Rise of the Confucian Model”, written by Marginson, S.

Figure 2 shows the thematic areas where contributions are classified during the period 1969-2019. In the first place, Social Sciences stands out significantly, with 678 articles; Arts and Humanities (195); Business, Management and Accounting (110); Engineering (90); Computer Science (71); and Psychology (60). The rest of the thematic areas do not exceed 4% of the contributions. It should be noted that the same article can be classified in more than one area, following the criteria of the editor, the journal, and the author.

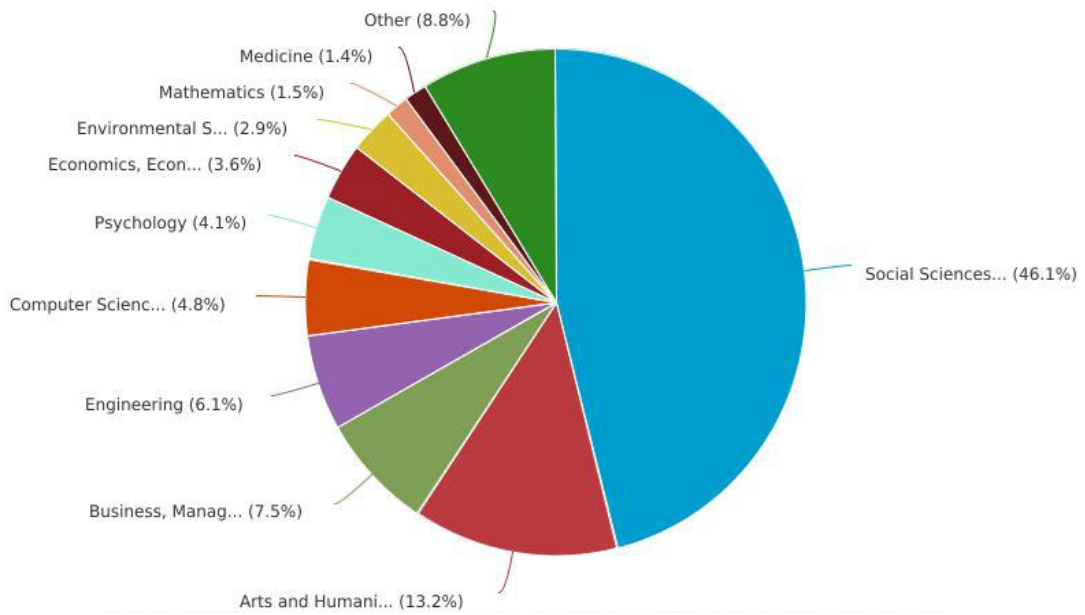


Figure 2. Main thematic areas (1969-2019) Source: Scopus

Figure 3 represents the 10 most productive countries in this research topic. The United States stands out, with 149 articles, which represents 16.32% of the total. They are followed by the United Kingdom (140; 15.33%), Russia (76; 8.32%), Spain (68; 7.44%) and Australia (66; 7.22%).

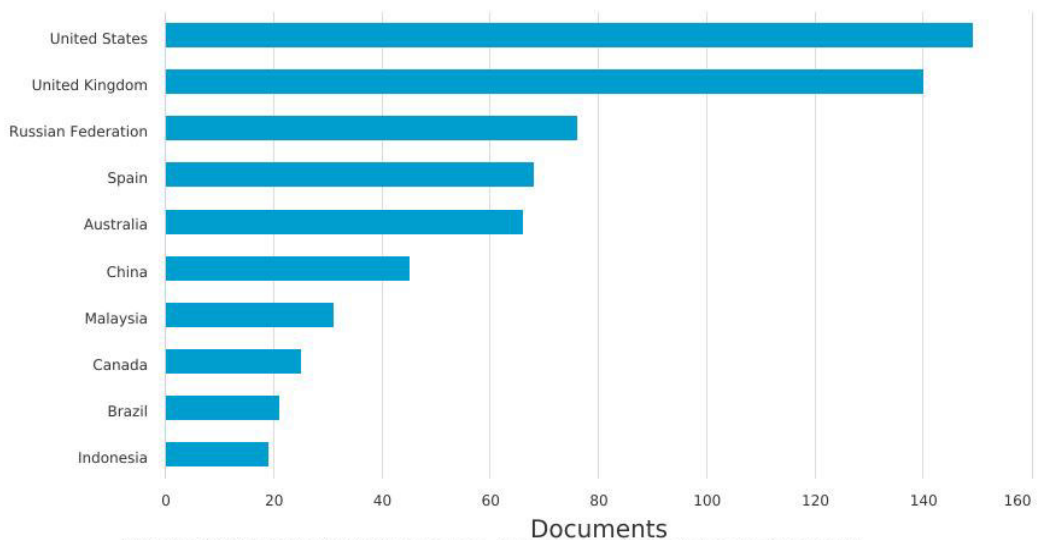


Figure 3. Main countries (1969-2019) Source: Scopus

Likewise, the authors who have published the most on artistic teaching and creative thinking in university contexts have been, with 4 articles Chernyaeva, I.V and with 3 articles each, Chen, I.S.; Chen, J.K.; Gu, J.; Kuimova, M.V.; Poce, A.; and Akhmetova, Z.

On the other hand, in relation to the most productive research organizations, these have been the Kazan Federal University, with 11 articles; the Universiti Kebangsaan Malaysia, with 9; the Queensland University of Technology QUT RMIT, University Universiti Teknologi Malaysia and University of Illinois at Urbana-Champaign, with 7 articles published each.

3.2. Analysis of Scientific Collaboration Networks

In this section, the main cooperation networks between the different agents driving this study topic (authors, research institutions and countries) are analysed. Figure 4 shows the scientific collaboration network based on the co-authorship of articles on artistic teaching and creative thinking in university contexts. The authors were associated, according to the VOSviewer tool, in 2 groups.

Group 1, pink colour, is led by Burgoyne L. and is associated, among others, with the authors Cantillon-Murphy P., O'Flynn S., O'tuathaigh C., Shorten G., Spoelstra H., Stoyanov S., Sweeney C., and Van Huffel S.

Group 2, green, is headed by Bennett D. and is associated with Blom D., Dunbar-Hall P., Hitchcock M., and Rowley J.

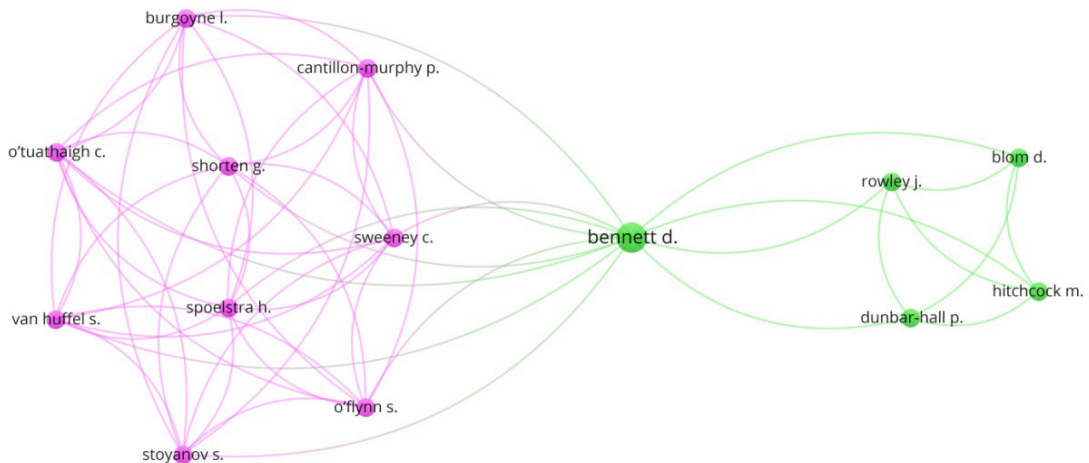


Figure 4. Network of authors based on co-authorship (1969–2019). Source: VOSviewer

Figure 5 shows the network of scientific collaboration between organizations according to the co-authorship of documents about study. Thus, the organizations were associated in 4 groups.

The first, pink, is the most numerous and is made up of the Queensland University of Technology (Australia); Universidade de Brasilia (Brazil); University of South Australia (Australia); Anglia Ruskin University (Cambridge, United Kingdom); Center For Teaching and Learning, University of Limerick (Ireland); Durham University (United Kingdom); Faculty of Arts and Social Sciences, University of Southampton (United Kingdom); and the Graduate Institute of Futures Studies, Tamkang University (Taiwan), among others.

While in group 2, green, are grouped the organizations University of Strathclyde (Glasgow, United Kingdom); Universiti Sains Malaysiapenang (Malaysia); Deakin University (Australia); and Umea University (Sweden), among others.

Group 3, red, is made up of the Arc Center of Excellence for Creative Industries and Innovation, Queensland University of Technology (Australia); Coventry University, (United Kingdom); Faculty of Arts, University of British Columbia (Canada); University of Wollongong (Australia); Faculty of Creative Industries, and the Queensland University of Technology (Brisbane, Australia).

Finally, group 4, yellow, is made up of universities by De Montfort University (United Kingdom); Harbin Normal University (China); King Alfred's College Winchester, United Kingdom; De Montfort University (United Kingdom).

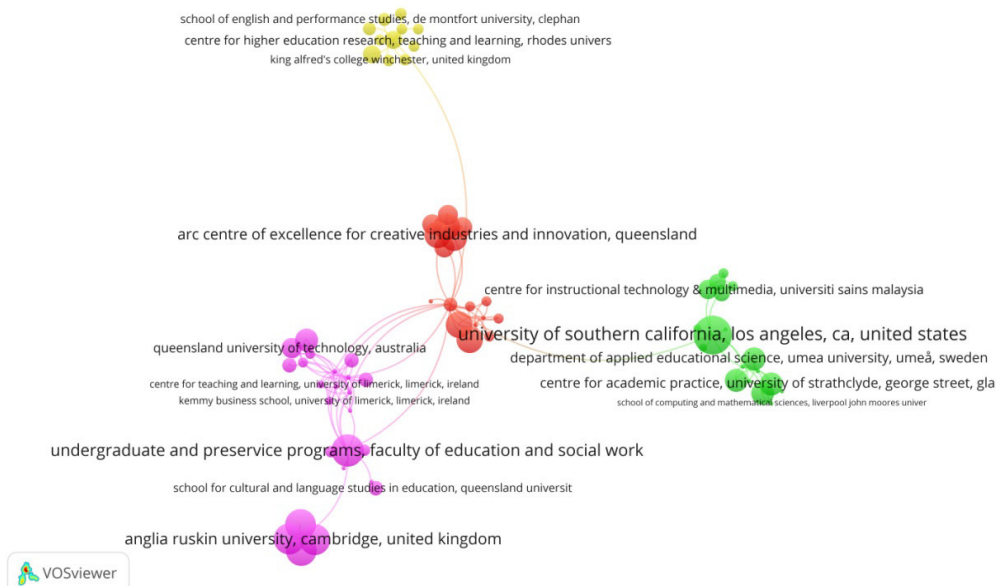


Figure 5. Network of organizations based on cooperation (1969–2019). Source: VOSviewer

Hence, 81 countries have contributed jobs to the development of this field of research. Figure 6 shows the collaboration between the main countries based on the co-authorship of their authors. The map defined by different colours represents the groups of countries, while the size of the circle varies depending on the number of contributions from each country. In this way, the larger the circle that represents each country, the greater the number of contributions whose authorship it symbolizes. The VOSviewer software has detected that they are associated according to five different groups.

Group 1 (pink), the most numerous, is headed by the United Kingdom, and is linked, among others, with Australia, Sweden, Finland, Malaysia, Indonesia, Germany, Brazil, South Africa, Portugal, Singapore, and Iran.

On the other hand, group 2 (green) is led by Austria and is associated, among others, with Spain, Canada, Holland, France, Belgium, Ireland, Israel, Switzerland, Pakistan, and Mexico, among others.

Meanwhile, group 3 (red) is headed by Russia and is associated with China, Germany, Taiwan, Greece, Hong Kong, United Kingdom, Raine, South Korea, and Bangladesh, among others.

Likewise, group 4 (yellow) is led by Indonesia and is linked, among others, with Brazil, Vietnam, Slovenia, Mexico, Thailand, Norway, Belgium, Croatia, Denmark, Guatemala, North Macedonia, and Serbia.

Finally, group 5 (purple), the least numerous, is led by the United States and is associated, among others, with South Africa, Turkey, Cyprus, Kenya, Venezuela, Peru, Nigeria, and Zimbabwe.

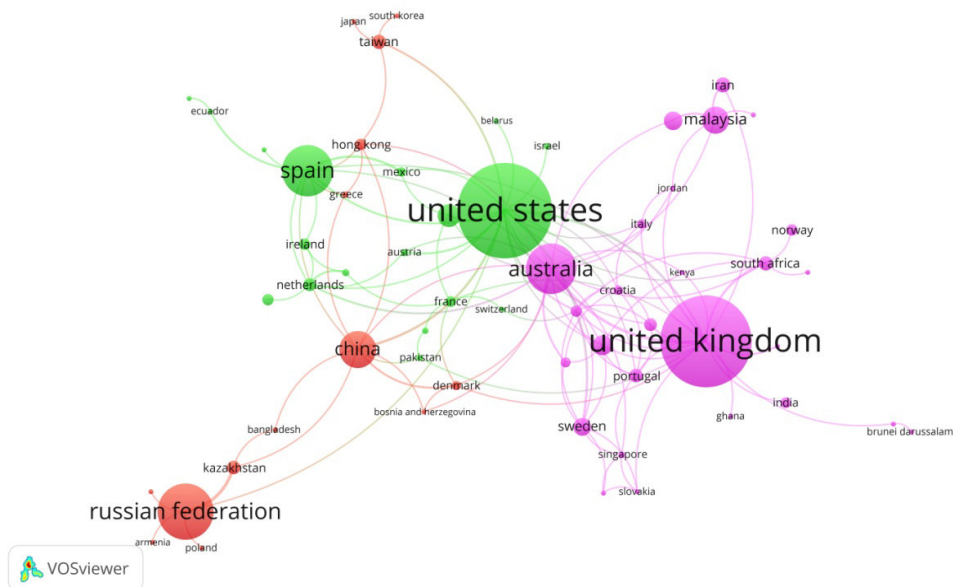


Figure 6. Network of countries/territories based on co-authorship (1969–2019). Source: VOSviewer

3.3. *Keyword Analysis*

In the selected sample of 913 articles, 3547 different keywords have been identified that make up the breadth of terms and concepts of the study topic. The analysis of the set of keywords of a specific research topic allows to know the main lines of research that are developed by the main agents that promote it (authors, organizations, and countries).

Figure 7 presents the network map for the keywords of the complete sample of the contributions analysed on artistic teaching and creative thinking in university contexts. The size of the circle represents the number of articles in which each keyword appears, and the colour indicates the group in which the keyword is included based on the number of joint occurrences.

VOSviewer has identified 6 main groups representing the different views on research in this field of study. The main keywords are creativity, university, culture, arts, perception, sustainability; around which the rest of the terms of the publications on this research topic are linked.

In this study, the first group (pink) is led by the term creativity. This is associated, among others, with the following terms: higher education, education, teaching, innovation, learning, art, entrepreneurship, critical thinking, knowledge, creative thinking, design, sustainable development, training, employability, pedagogy, collaborative learning, and -learning, experiential learning, design education, art education and creative works, among others.

This first line of research examines and develops the creative process as a social phenomenon, that is, creativity based on the interaction between individuals. Man is permeable to stimuli, a quality that allows us to enrich our ideas (Davies et al, 2011; Van de Kamp et al, 2015; Vigotsky, 2003).

The second group (green) is headed by the term university and is associated with terms such as motivation, diversity, leadership, psychology, communication, competence, imagination, methodology, professional competence, identity, adaptation, awareness, emotion, empowerment, and faculty, among the most prominent.

This second component has focused on the university, as the institution of higher education that links visual communication with the emotions of the individual, in relation to the transmission of ideas and information that can be perceived with sight (Davies et al, 2011; Larson & Miller, 2011; UNESCO, 2010).

In group 3 (red) the term culture stands out and is linked to economics, employment, organization, communication skill, interview, research work, attitude, cultural anthropology, personnel, human resources, social psychology, and economic factors, among others.

This line of research focuses on the study of visual literacy where it is intended to encompass a combination of cultural studies with visual elements.

In this way, the academic, economic, human, and psychological fields are included, among others, and includes the visualized human experience embodied in the history of art, architecture, photography, critical theory, philosophy and anthropology and other visual realities (González-Zamar & Abad-Segura, 2020; Hetland, 2013; Niu & Sternberg, 2003).

Meanwhile, group 4 (yellow) led by the term arts is associated with visual creative teaching method, design education, learning, skill, decision making, creative work, fine arts, industrial design, performance, product design, 3D printing, architecture, blended learning, creative problem solving, development, environmental education, industry, artificial intelligence, computer aided instruction, creativity development and education program.

This group has contributed to developing aspects related to the visual arts, regarding the set of artistic manifestations of a visual nature (traditional plastic disciplines, new forms of expression that appeared during the second half of the 20th century and artistic manifestations related to new technologies). Thus, this line has contributed to highlighting disciplines such as painting, drawing, engraving and sculpture, photography, video art, artistic action or performance, graffiti, augmented reality, or virtual reality (González-Zamar & Abad-Segura, 2020; Efland, 1990).

Group 5 (violet) is led by perception and is associated with terms such as: deep learning, learning environment, midwife, problem-based learning, program evaluation, lateral thinking, personal experience, problem-based learning, transformative learning, DNA transcription, memory, and flexible pedagogies.

In this sense, this fifth line of research contributes to the analysis of artistic perception, that is, to the forms with which the individual receives or perceives with the senses some sensation due to an art form. Hence, through artistic expressions (music, dance, poems, literature, sculpture, painting, etc.) we can express and indicate what we feel (González-Zamar et al, 2020; Larson & Miller, 2011).

Finally, the sixth group (blue) is headed by the term sustainability and is associated with urban economy, urban growth, global economy, economic growth, and smart city.

In this sixth group, the line of research on the concept of sustainable art has been developed, from different approaches, such as economic, urban, architectural, among others. This seeks the inclusion in the works that comprise it, of aspects related to ecology and the denunciation of actions that degrade the environment, as well as the support of social causes (Abad-Segura et al, 2020; Craft, 2001; Vigotsky, 2003).

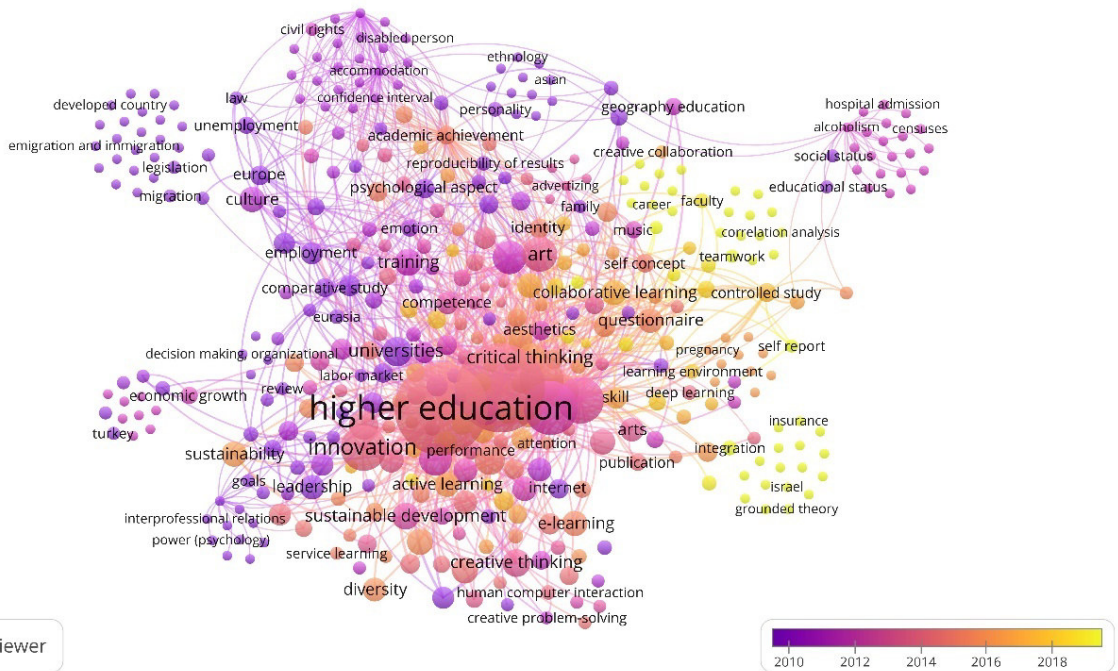


Figure 8. Evolution of keywords network based on co-occurrences (1969–2019). Source: VOSviewer

4. Conclusions

The objective of this study was to analyse the evolution of scientific production and research trends at a global level, during the last 50 years (1969-2019), on artistic teaching and creative thinking in university contexts.

To do this, a bibliometric analysis of a sample of 913 scientific articles obtained from Elsevier's Scopus database has been developed. Fundamentally, the evolution of the number of articles, the thematic areas where they are classified, the journals where they are published, the authors, the research institutions and the most productive countries have been identified.

At a global level, five lines of research developed from 1969 to 2019 have been identified, which mainly study concepts such as: creativity, university, culture, arts, perception, and sustainability.

This work involves an analysis of scientific production and the main driving agents that energize research on artistic teaching and creative thinking in university contexts, during the period 1969-2019, as well as the identification of lines of research.

The evolution in this subject has been identified from the morphology of the groups of authors, institutions, countries and keywords, and the intensity of the relationships that develop in them. The results obtained are a

complement to the knowledge of research on artistic teaching and creative thinking in university contexts, and allow establishing the relationship between education and art. The research helps generate new qualitative insights and serves as an entry point for future discussions. By having a broad view of the research landscapes, you can quickly identify emerging areas of interest.

This research has a set of limitations, which have conditioned the results obtained, and these could be considered as the basis for future research articles. Among these, we can highlight the Scopus database chosen to apply the methodology, as well as the keywords selected to extract the article sample, the study period, the bibliometric methodology used and even the variables examined. It is also necessary to recognize that using data mining, you can explore large databases and find repetitive patterns that explain the behaviour of this data.

Finally, it has been observed that international research on artistic teaching and creative thinking in university contexts shows an upward trend, derived mainly from the number of articles, such as the lines of research developed, which indicates the growing interest in the academic community and scientific. Future lines of research refer to the development of themes related to literacy and visual culture, perception, and sustainability in the plastic and visual arts.

In other words, it is noted that scientific activity on artistic teaching and creative thinking in university contexts takes place in a conducive environment, with a general interest in the dissemination of the results of publications, allowing technical progress.

References

- Abad-Segura, E., y González-Zamar, M. D. (2019). Effects of financial education and financial literacy on creative entrepreneurship: A worldwide research. *Education Sciences*, 9(3), 238. doi: 10.3390/educsci9030238
- Abad-Segura, E.; González-Zamar, M.-D.; Infante-Moro, J. C. y Ruipérez García, G. (2020). Sustainable management of digital transformation in higher education: Global research trends. *Sustainability*, 12(5), 2107. doi: 10.3390/su12052107
- Craft, A. (2001). An analysis of research and literature on creativity in education. *Qualifications and Curriculum Authority*, 51(2), 1-37.
- Davies, A., Fidler, D. y Gorbis, M. (2011). *Future Work Skills 2020*. Palo Alto, CA: Institute for the Future for University of Phoenix Research Institute.

- Efland, A.D. (1990). *A History of Art Education*. New York: Teachers College Press
- González-Zamar, M. D., Abad-Segura, E., Luque de la Rosa, A., y López-Meneses, E. (2020). Digital education and artistic-visual learning in flexible university environments: Research analysis. *Education Sciences*, 10(11), 294. doi: 10.3390/educsci10110294
- González-Zamar, M. D., y Abad-Segura, E. (2020). Implications of virtual reality in arts education: Research analysis in the context of higher education. *Education Sciences*, 10(9), 225. doi: 10.3390/educsci10090225
- Guerrero-Baena, M. D., Gómez-Limón, J. A., y Fruet Cardozo, J. V. (2014). Are multi-criteria decision-making techniques useful for solving corporate finance problems? A bibliometric analysis. *Revista de Métodos Cuantitativos para la Economía y la Empresa*, 17, 60-79. doi: 10.46661/revmetodoscuanteconempresa.3624
- Hailey, D. (2014). Visual thinking, art, and university teaching across disciplines. *About Campus*, 19(4), 9-16. doi: 10.1002/abc.21163
- Hetland, L. (2013). *Studio thinking 2: The real benefits of visual arts education*. Teachers College Press.
- Larson, L. C., y Miller, T. N. (2011). 21st century skills: Prepare students for the future. *Kappa Delta Pi Record*, 47(3), 121-123. doi: 10.1080/00228958.2011.10516575
- Leydesdorff, L. y Vaughan, L. (2006). Co - occurrence matrices and their applications in information science: Extending ACA to the Web environment. *Journal of the American Society for Information Science and technology*, 57(12), 1616-1628. doi: 10.1002/asi.20335
- Niu, W., y Sternberg, R. J. (2003). Societal and school influences on student creativity: The case of China. *Psychology in the Schools*, 40(1), 103-114. doi: 10.1002/pits.10072
- Osareh, F. (1996). Bibliometrics, citation analysis and co-citation analysis: A review of literature I. *Libri*, 46(3), 149-158.
- UNESCO (2010). Closing session of the Second World Conference on Arts Education, Final Report by Professor Larry O'Farrell, Rapporteur General of the Conference, Seoul, May 28, 2010.
- Van de Kamp, M. T., Admiraal, W., van Drie, J., y Rijlaarsdam, G. (2015). Enhancing divergent thinking in visual arts education: Effects of explicit instruction of meta - cognition. *British Journal of Educational Psychology*, 85(1), 47-58. doi: 10.1111/bjep.12061
- Van Eck, N.J. y Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84, 523-538. doi: 10.1007/s11192-009-0146-3
- Vigotsky, L. S. (2003). *La imaginación y el arte en la infancia* (87). Ediciones Akal.

Vinkler, P. (2010). Indicators are the essence of scientometrics and bibliometrics. *Scientometrics*, 85(3), 861-866. doi: 10.1007/s11192-010-0159-y



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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 & EYDGHI, 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 (Bassegy, 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 LinkedIn 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.

References

- Alarcón, R., Blanca, M. J., & Bendayan, R. (2017). The student satisfaction with educational podcasts questionnaire. *Escritos de Psicología / Psychological Writings*, 10(2), 126–133. doi: 10.5231/psy.writ.2017.14032
- Anteby, R., Amiel, I., Cordoba, M., Axelsson, C. G. S., Rosin, D., & Phitayakorn, R. (2021). Development and utilization of a medical student surgery podcast during COVID-19. *The Journal of Surgical Research*, 265, 95-99. doi: 10.1016/j.jss.2021.03.059
- Barnes, J., Carraway, C., & Jones, S. (2021). Using lecture podcasts in the COVID-19 transition to virtual post-secondary education in agriculture. *Natural Sciences Education*, 50(2), e20064. doi: 10.1002/nse2.20064
- Bassey, M. (1999). *Case study research in educational settings*. Buckingham, ENG: Open University Press.
- Blum, C. A. (2018). Does Podcast Use Enhance Critical Thinking in Nursing Education? *Nursing Education Perspectives*, 39(2), 91–93. doi: 10.1097/01.NEP.0000000000000239
- Carvalho, A. A., Aguiar, C., Santos, H., Oliveira, L., Marques, A., & Maciel, R. (2009). Podcasts in higher education: Students' and lecturers' perspectives. In A. Tatnall & A. Jones (Eds.), *Education and technology for a better world* (Vol. 302 AICT, pp. 417–426). Berlin, DE: Springer. doi: 10.1007/978-3-642-03115-1_44
- Celaya, I., Ramírez-Montoya, M. S., Naval, C., & Arbués, E. (2020). Uses of the podcast for educational purposes. Systematic mapping of the

- literature in WoS and Scopus (2014-2019). *Revista Latina de Comunicacion Social*, (77), 179-201. doi: 10.4185/RLCS-2020-1454
- Chester, A., Buntine, A., Hammond, K., & Atkinson, L. (2011). Podcasting in education: Student attitudes, behaviour and self-efficacy. *Educational Technology and Society*, 14(2), 236–247.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd. ed.). Lawrence Erlbaum Associates, Publishers.
- Cosimini, M. J., Cho, D., Liley, F., & Espinoza, J. (2017). Podcasting in Medical Education: How Long Should an Educational Podcast Be? [Comment to the Editor]. *Journal of Graduate Medical Education*. doi: 10.4300/JGME-D-17-00015.1
- Drew, C. (2017). Educational podcasts: A genre analysis. *E-Learning and Digital Media*, 14(4), 201-211. doi: 10.1177/2042753017736177
- Edison Research. (2019). *The Podcast Consumer*. Retrieved from <http://www.edisonresearch.com/wp-content/uploads/2019/04/Edison-Research-Podcast-Consumer-2019.pdf>
- Edison Research. (2021). *The Infinite Dial*. Retrieved from <http://www.edisonresearch.com/wp-content/uploads/2021/03/The-Infinite-Dial-2021.pdf>
- Fernández, V., Sallan, J. M. & Simo, P. (2015). Past, present, and future of podcasting in Higher Education. In M. Li & Y. Zhao (Eds.), *Exploring learning & teaching in Higher Education. New frontiers of educational research*, (pp. 305-330). New York: Springer. doi: 10.1007/978-3-642-55352-3_14
- Figueras-Maz, M., Ferrés, J., & Mateus, J. C. (2018). Perceptions on the use of mobile devices in the classroom in coordinators of teaching innovation from Spanish universities. *Prisma Social*, (20), 160–179.
- Fox, K., Bryant, G., Lin, N., & Srinivasan, N. (2020). *Time for class – COVID-19 Edition Part 1: A national survey of faculty during COVID-19*. Tyton Partners and Every Learner Everywhere. Retrieved from <https://www.everylearnereverywhere.org/wp-content/uploads/TimeforClass-COVID19-Part-1-NationalFacultySurvey-Final.pdf>
- Gachago, D., Livingston, C., & Ivala, E. (2016). Podcasts: A technology for all?. *British Journal of Educational Technology*, 47(5), 859–872. doi: 10.1111/bjet.12483
- Goldman, T. (2018). The Impact of Podcasts in Education. *Advanced Writing: Pop Culture Intersections* 29, 1-15. Retrieved from https://scholarcommons.scu.edu/engl_176/29
- Gonzalez, M., & Moore, N. (2020). A comparison of faculty and graduate students’ perceptions of engaging online courses: A mixed-method study. *International Journal of Educational Methodology*, 6(1), 223-236. doi: 10.12973/ijem.6.1.223

- Hew, K. F. (2009). Use of audio podcast in K-12 and higher education: A review of research topics and methodologies. *Educational Technology Research and Development*, 57(3), 333–357. doi: 10.1007/s11423-008-9108-3
- Hodges, C. B., Moore, S., Lockee, B. B., Trust, T. & Bond, A. (2020, March 27). *The difference between emergency remote teaching and online learning*. Educause. Retrieved from <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hussar, B., Zhang, J., Hein, S., Wang, K., Roberts, A., Cui, J.,..., & Dilig, R. (2020). *The Condition of Education 2020* (NCES 2020-144). U.S. Department of Education. National Center for Education Statistics. Retrieved from <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020144>.
- Jaschik, S. & Lederman, D. (2019). *2019 Survey of Faculty Attitudes on Technology* (A study by Inside Higher Ed and Gallup). Inside Higher Ed. Retrieved from <https://www.insidehighered.com/booklet/2019-survey-faculty-attitudes-technology>
- Justus, M. (2017). The role of pedagogical beliefs in emerging technology integration: An exploratory case study of faculty perspectives. *Qualitative Report*, 22(2), 499–526.
- Kennette, L.N. & Wilson, N.A. (2019). Universal Design for Learning (UDL): Student and Faculty Perceptions. *Journal of Effective Teaching in Higher Education*, 1(2), 1-26. doi: 10.36021/jethe.v2i1
- Khechine, H., Lakhali, S., & Pascot, D. (2013). University students' perception of the pedagogical use of podcasts: A case study of an online information system course. *Journal of Education and Training Studies*, 1(2), 136–151. <https://doi.org/10.11114/jets.v1i2.139>
- Koul, S. & Eydgahi, A. (2017). A systematic review of technology adoption frameworks and their applications. *Journal of Technology Management & Innovation*, 12(4), 106-113.
- Lai, P.C. (2017). The literature review of technology adoption models and theories for the novelty technology. *Journal of Information Systems and Technology Management*, 14(1), 21-38. doi: 10.4301/S1807-1775201700100002
- Lehdonvirta, V., Oksanen, A., Räsänen, P., & Blank, G. (2020). Social media, web, and panel surveys: Using non-probability samples in social and policy research. *Policy & Internet*, 0(0), 1-22. doi: 10.1002/poi3.238
- Luttenberger, S., Macher, D., Maidl, V., Rominger, C., Aydin, N., & Paechter, M. (2018). Different patterns of university students' integration of lecture podcasts, learning materials, and lecture attendance in a psychology course. *Education and Information Technologies*, 23(1), 165-178. doi: 10.1007/s10639-017-9592-3

- Matava, C. T., Rosen, D., Siu, E., & Bould, D. M. (2013). eLearning among Canadian anesthesia residents: A survey of podcast use and content needs. *BMC Medical Education*, 13(1), 1–8. doi: 10.1186/1472-6920-13-59
- McCombs, S., & Liu, Y. (2007). The efficacy of podcasting technology in instructional delivery. *International Journal of Technology in Teaching and Learning*, 3(2), 123-134.
- McKinney, D., Dyck, J.L. & Lubert, E.S. (2009). iTunes University and the classroom: Can podcasts replace professors? *Computers & Education*, 52(3), 617-623.
- Merhi, M.I. (2015). Factors influencing higher education students to adopt podcast: An empirical study. *Computers & Education* 83, 32-43. doi: 10.1016/j.compedu.2014.12.014
- Mou, Y., & Lin, C.A. (2015). Exploring podcast adoption intention via perceived social norms, interpersonal communication, and theory of planned behavior. *Journal of Broadcasting & Electronic Media* 59(3), 475–493. doi: 10.1080/08838151.2015.1054997
- Nalendra, A. R. A., Rahayuningsih, R., Rosalinah, Y., Subroto, I., Wibowo, A. I., & Nelfianti, F. (2020). E-learning for english for business-based podcast: One of learning solutions amid the pandemic of COVID-19. *Journal of Physics. Conference Series*, 1641(1) doi: 10.1088/1742-6596/1641/1/012111
- Ng'ambi, D., & Lombe, A. (2012). Using podcasting to facilitate student learning: A constructivist perspective. *Educational Technology and Society*, 15(4), 181–192.
- Observatorio del podcast de Puerto Rico. (2021). Informe acerca del podcast y Puerto Rico. Retrieved from <https://www.jyestudio.com/observatorio-podcastpr/informe-podcast/>
- Ogrezeanu, A. (2015). Models of technology adoption: An integrative approach. *Network Intelligence Studies* 3(1), 55-67.
- Ortagus, J. C. (2015). *From the periphery to prominence: An examination of the profile and academic outcomes of postsecondary online students* (Publication No. 28213020) [Doctoral dissertation, The Pennsylvania State University]. ProQuest Dissertations & Theses Global.
- Palenque, S. M. (2016). The power of podcasting: Perspectives on pedagogy. *Journal of Instructional Research*, 5, 4-7.
- Pegrum, M., Bartle, E., & Longnecker, N. (2015). Can creative podcasting promote deep learning? The use of podcasting for learning content in an undergraduate science unit. *British Journal of Educational Technology*, 46(1), 142–152. doi: 10.1111/bjet.12133
- Pew Research Center. (2021). *Social Media Use in 2021*. Retrieved from <https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/>

- Pinto, M. & Leite, C. (2020). Digital technologies in support of students learning in Higher Education: Literature review. *Digital Education Review* 37, 343-360. Retrieved from <http://greav.ub.edu/der/>
- Podcaster@s. (2019). *Encuesta Pod 2019: Un estudio para conocer a las audiencias de podcast en español*. Retrieved from http://encuestapod.com/EncuestaPod2019_Podcasteros.pdf
- Strickland, K., Gray, C., & Hill, G. (2012). The use of podcasts to enhance research-teaching linkages in undergraduate nursing students. *Nurse Education in Practice*, 12(4), 210–214. doi: 10.1016/j.nepr.2012.01.006
- Tejedor, S., Cervi, L., Pérez-Escoda, A., Tusa, F. & Parola, A. (2021). Higher education response in the time of Coronavirus: Perceptions of teachers and students, and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity* 7(1) 43. doi: 10.3390/joitmc7010043
- Tight, M. (2010). The curious case of case study: A viewpoint. *International Journal of Social Research Methodology*, 13(4), 329–339. doi: 10.1080/13645570903187181
- Trujillo Torres, J.M. (2011). The use of podcasts in higher education: Communication, innovation, education and knowledge management. *International Journal of Educational Technology in Higher Education*, 8(2), 225–240. doi: 10.7238/rusc.v8i2.1047
- Tulinayo, F.P., Ssentume, P., & Najjuma, R. (2018). Digital technologies in resource constrained higher institutions of learning: A study on students' acceptance and usability. *International Journal of Educational Technology in Higher Education*, 15(36), 1-19. doi: 10.1186/s41239-018-0117-y
- Van Zanten, R., Somogyi, S., & Curro, G. (2012). Purpose and preference in educational podcasting. *British Journal of Educational Technology*, 43(1), 130–138. doi: 10.1111/j.1467-8535.2010.01153.x
- Vargas, E. (2019). Podcasting en Puerto Rico: pasado, presente y futuro. Retrieved from <https://medium.com/@lospodcasteros/podcasting-en-puerto-rico-pasado-presente-y-futuro-62fe1225e86c>
- Vehovar, V., & Manfreda, K.L. (2017). Overview: online surveys. In N. Fielding, R. Lee, & G. Blank (Eds.), *The SAGE Handbook of online research methods* (pp. 143-161). SAGE Publications Ltd. doi: 10.4135/9781473957992.n9
- Zacharis, N.Z. (2012). Predicting college students' acceptance of podcasting as a learning tool. *Interactive Technology and Smart Education*, 9(3), 171-183. doi: 10.1108/17415651211258281.



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A Comparison of Angoff's and Holland's Assumptions in the Levine Observed Score Equating Method: An Educational and Evaluation Study

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Abstract: Evaluation and assessment processes are fundamental in educational dynamics, especially in higher education. In this context, the use of tests is every day and, in many circumstances, essential. In relation precisely to the tests, this study examined the operation of certain assumptions in the context of the Non-Equivalent groups with Anchor Test (NEAT) design under particular conditions using a simulation in which complete information on the performance of groups P and Q on tests X and Y would be known. Then the estimates could be compared against actual values. Results indicate that the difference in estimation from both assumptions appears to be of no practical significance, given that this difference is not expected to result in a change in actually reported scores. Practitioners need to know the implications of the use of different assumptions when choosing an equating method. Equating is very important, especially when different forms of a test are administered. If different forms show high differences in difficulty, the test results would not be comparable, and the test takers would not be treated fairly.

Key-words: evaluation; assessment; higher education; test; NEAT equating methodology.

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1. Introduction

Equating aims to produce comparable reported test scores regardless of which test form is taken. (Albano, 2016). For this purpose, it attempts to remove score differences due to test form difficulty so that only test takers' ability differences are reflected in the test scores (Elosua & Hambleton, 2018).

A popular data collection design for equating is the Non-Equivalent groups with Anchor Test (NEAT) design (Akin, 2019, Gübes & Uyar 2020, Want et al 2020). When carrying out observed score equating under this design, some assumptions are made in order to estimate the unknown information. This study compares one traditional assumption made in the Levine observed score equating method under the NEAT design with an alternative assumption in order to establish which one is more viable across populations with different characteristics.

The NEAT design involves two groups that do not have to be of equal ability. One group P gets Form X and an anchor test A and the other group Q gets Form Y and the anchor test A (Kolen & Brennan, 2014). The anchor test measures differences in group ability (see Table 1). The object of equating techniques in the context of the NEAT design is to estimate how some total group T , which is a weighted combination of groups P and Q , would perform on both tests X and Y . The estimation involves two unknown pieces of information: the performance of group P on test Y and the performance of group Q on test X . Once these estimates are obtained, then performance on tests X and Y can be directly compared in T and the two tests can be thus equated to each other.

	Group P	Group Q
Form X	✓	
Form Y		✓
Anchor A	✓	✓

Table 1. The following table illustrates the NEAT design.

In the Levine observed score method, three assumptions are traditionally made so that unknown information from Test Y for group P and Test X for group Q can be estimated. Following Holland and Walker (2006) these three assumptions will be denoted L1, L2 and L3 and are indicated below.

L1) $X = \tau_X + e_X$, $Y = \tau_Y + e_Y$, and $A = \tau_A + e_A$, along with the usual assumption that the error terms, e_X , e_Y , and e_A , are uncorrelated with their corresponding true scores, τ_X , τ_Y , and τ_A .

L2) $\tau_X = a + b\tau_A$, and $\tau_Y = c + d\tau_A$. i.e. the true scores of X and A and Y and A are linearly related. This is the congenericity assumption.

The Levine method rests on the assumption that L1 and L2 hold for any population T of the synthetic form

$$T = wP + (1 - w)Q, \quad (1)$$

where $0 < w < 1$ (Braun & Holland, 1982). Note that Levine (1955) did not explicitly introduce the concept of a synthetic group, so that the treatment here is somewhat more general than Levine (Kolen & Brennan, 2014).

L3) The error variances $\sigma_{e_X T}^2$, $\sigma_{e_Y T}^2$ and $\sigma_{e_A T}^2$ are the same for any T of the synthetic form. This assumption, along with an assumption of proportional error variances for X , Y , and A , is used in the computation of Angoff's (1971) reliability estimates. Although Levine observed score equating can be computed using other reliability estimates, Angoff's estimates are traditionally used with Levine equating because they result in several desirable properties (in particular, several different linear methods become equivalent to each other when Angoff's estimates are used; see Petersen, Kolen & Hoover, 1989). For this reason, L3 will be referred to as Angoff's assumption in this paper, although it did not originate with him.

An alternative assumption to L3 has been proposed by Holland (2004; see also Holland & Walker, 2006) and it is denoted here by L3*.

L3*) The ratios, $\frac{\rho_{XT}}{\rho_{AT}}$ and $\frac{\rho_{YT}}{\rho_{AT}}$, are constant as functions of T of the synthetic form (Holland & Walker, 2006); that is, the ratios of the square roots

of the reliabilities, $\frac{\rho_{XT}}{\rho_{AT}}$ and $\frac{\rho_{YT}}{\rho_{AT}}$, are population invariant.

The idea behind this L3* assumption is that from L1 and L2 it can be shown that

$$\sigma_{XT} = \sigma_{XP} \frac{\sigma_{AT}}{\sigma_{AP}} \left[\frac{\rho_{XP}}{\rho_{AP}} / \frac{\rho_{XT}}{\rho_{AT}} \right] \quad \text{and} \quad \sigma_{YT} = \sigma_{YQ} \frac{\sigma_{AT}}{\sigma_{AQ}} \left[\frac{\rho_{YQ}}{\rho_{AQ}} / \frac{\rho_{YT}}{\rho_{AT}} \right]$$

(Holland & Walker, 2006).

Under L3* the previous two formulas reduce to

$\sigma_{XT} = \sigma_{XP} \frac{\sigma_{AT}}{\sigma_{AP}}$ and $\sigma_{YT} = \sigma_{YQ} \frac{\sigma_{AT}}{\sigma_{AQ}}$ because the value in brackets will be equal to 1.0.

The next section presents the derivation of such formulas.

The purpose of this study is then to use a simulation to determine which of two assumptions - Angoff's constant error variance assumption (L3) or Holland's constant reliability ratio assumption (L3*) - is more viable across a wide range of populations T .

2. Derivation of formulas

The following derivation of formulas is based on Holland & Walker (2006).

2.1. Results from using just L1 and L2.

Several simplifying consequences can be derived from assumptions L1 and L2.

From L1 for any T , the mean of X and of τ_X over T are the same, i.e.,

$$\mu_{XT} = E(X|T) = E(\tau_X|T) = \mu_{\tau_X T}, \quad (2)$$

Similar results hold for Y and A as well.

Taking expectations over T of the linear equations in L2, and then letting $w = 1$ so that $T = P$, results in

$$a = \mu_{XT} - b\mu_{AT} = \mu_{XP} - b\mu_{AP},$$

by the rules of expectations of functions, and implies the following basic formula for μ_{XT} in terms of quantities that can be estimated directly in the NEAT design plus the unknown value of b ,

$$\mu_{XT} = \mu_{XP} + b(\mu_{AT} - \mu_{AP}). \quad (3)$$

By an analogous argument a formula for μ_{YT} is obtained:

$$\mu_{YT} = \mu_{YQ} + d(\mu_{AT} - \mu_{AQ}). \quad (4)$$

In addition, taking variances over T of the linear equations in L2, and then letting $w = 1$ so that $T = P$, results in

$$\sigma_{\tau_{XT}}^2 = b^2 \sigma_{\tau_{AT}}^2 \text{ and } \sigma_{\tau_{XP}}^2 = b^2 \sigma_{\tau_{AP}}^2. \quad (5)$$

This follows directly from the definition of the variance of a function. Equation (5) implies the following formula for b and shows the sense in which it is the “effective length” of X relative to A ,

$$b = \frac{\sigma_{\tau_{XT}}}{\sigma_{\tau_{AT}}} = \frac{\sigma_{\tau_{XP}}}{\sigma_{\tau_{AP}}}. \quad (6)$$

The notion of *effective test length* is expressed as the ratio of the true score standard deviations. By an analogous argument the corresponding formula for d , can be derived:

$$d = \frac{\sigma_{\tau_{YT}}}{\sigma_{\tau_{AT}}} = \frac{\sigma_{\tau_{YQ}}}{\sigma_{\tau_{AQ}}}. \quad (7)$$

Observe that L2 gets its strength as an assumption from the requirement that it holds for any T , and is therefore *population invariant*.

2.2. Formulas for the variances of X and Y over T

There are at least two ways to obtain expressions for the variances of X and Y over T . The first assumes L1 and L2 and makes a population invariance assumption concerning the ratio of the reliabilities of X and A and of Y and A . The second approach, the more standard one, also assumes L1 and L2 but makes a different population invariance assumption concerning the error variances.

For the first approach, we begin by using the usual formulas for test reliability to express the relationship in (6) in slightly different terms. Define the *reliabilities* of X and A in T , as usual, as

$$\rho_{XT}^2 = \frac{\sigma_{\tau_{XT}}^2}{\sigma_{XT}^2} \text{ and } \rho_{AT}^2 = \frac{\sigma_{\tau_{AT}}^2}{\sigma_{AT}^2}, \quad (8)$$

so that,

$$\sigma_{\tau_{XT}} = \rho_{XT}\sigma_{XT} \text{ and } \sigma_{\tau_{AT}} = \rho_{AT}\sigma_{AT},$$

and hence from (6) that,

$$b = \frac{\rho_{XT}\sigma_{XT}}{\rho_{AT}\sigma_{AT}} = \frac{\rho_{XP}\sigma_{XP}}{\rho_{AP}\sigma_{AP}}. \quad (9)$$

From (9) it follows that

$$\sigma_{XT} = \sigma_{XP} \frac{\sigma_{AT}}{\sigma_{AP}} \left[\frac{\rho_{XP}}{\rho_{AP}} / \frac{\rho_{XT}}{\rho_{AT}} \right]. \quad (10)$$

Similarly, from L1 and L2 we also have

$$\sigma_{YT} = \sigma_{YQ} \frac{\sigma_{AT}}{\sigma_{AQ}} \left[\frac{\rho_{YQ}}{\rho_{AQ}} / \frac{\rho_{YT}}{\rho_{AT}} \right]. \quad (11)$$

Now the idea behind the first approach to estimating σ_{XT} and σ_{YT} is to assume that the expressions in brackets in (10) and (11) have the value 1.0;

that is, to assume that the *ratios* of the square roots of the reliabilities, $\frac{\rho_{XT}}{\rho_{AT}}$ and $\frac{\rho_{YT}}{\rho_{AT}}$, are *population invariant*. This is assumption L3*. Under this assumption, the standard deviations of X and Y over T are given by

$$\sigma_{XT} = \sigma_{XP} \frac{\sigma_{AT}}{\sigma_{AP}} \text{ and } \sigma_{YT} = \sigma_{YQ} \frac{\sigma_{AT}}{\sigma_{AQ}}. \quad (12)$$

The expressions in (12) are exactly the same as the corresponding standard deviations for chained linear equating.

The second approach exploits the well known decomposition of test score variance into true score variance and error variance; that is,

$$\sigma_{XT}^2 = \sigma_{\tau_{XT}}^2 + \sigma_{e_{XT}}^2.$$

The population invariance assumption is on the error variances, such that the variances $\sigma_{e_{XT}}^2$, $\sigma_{e_{YT}}^2$ and $\sigma_{e_{AT}}^2$ are constant for any T of the synthetic form. This is assumption L3. From L3 it follows that

$$\sigma_{XT}^2 - \sigma_{\tau_{XT}}^2 = \sigma_{XP}^2 - \sigma_{\tau_{XP}}^2, \quad (13)$$

or

$$\sigma_{XT}^2 = \sigma_{XP}^2 + (\sigma_{\tau_{XT}}^2 - \sigma_{\tau_{XP}}^2). \quad (14)$$

However, the equations in (5) show that (14) may be expressed as

$$\sigma_{XT}^2 = \sigma_{XP}^2 + b^2(\sigma_{\tau_{AT}}^2 - \sigma_{\tau_{AP}}^2). \quad (15)$$

Furthermore, L3 also implies that

$$\sigma_{\tau_{AT}}^2 - \sigma_{\tau_{AP}}^2 = \sigma_{AT}^2 - \sigma_{AP}^2$$

so that (15) reduces to

$$\sigma_{XT}^2 = \sigma_{XP}^2 + b^2(\sigma_{AT}^2 - \sigma_{AP}^2). \quad (16)$$

A similar result holds for σ_{YT}^2 , i.e.,

$$\sigma_{YT}^2 = \sigma_{YQ}^2 + d^2(\sigma_{AT}^2 - \sigma_{AQ}^2). \quad (17)$$

3. Method

This study tested L3 and L3* using a simulation, in which full information on performance of groups P and Q on tests X and Y would be known. Then the estimates could be compared against actual values. To replicate practical settings it was decided that the anchor test would have 50 items and the tests X and Y would have 100 items each. Test scores were generated as follows. For the anchor test A in population P , true scores were

generated under $N(25, 64)$. In population Q true scores for A were generated under $N(27, 81)$, so that population Q was more able and more variable than population P . Observed scores on test A were generated under L1 by using a binomial error model to generate error terms. Under the binomial error model, the (squared) conditional standard error of measurement (CSEM) is

$$\sigma_{A|\tau}^2 = \tau_A (n - \tau_A) / (n - 1)$$

determined by where n is the number of items in the test (Lord & Novick, 1968).

Once the error scores for A were generated under $N(0, \sigma_{A|\tau}^2)$, the observed A scores were obtained by adding the true scores and the corresponding error scores.

True X scores and true Y scores were generated under L2 ($\tau_X = a + b\tau_A$ and $\tau_Y = c + d\tau_A$). The choice of a , b , c and d was made to replicate reasonable values in practical settings, given the desired maximum score of 100 for both tests: $a=2$, $b=2.1$, $c=4$, and $d=1.9$. The result was a test X that was somewhat easier across the majority of the score range.

Observed X and Y scores were generated under the binomial error model in a similar way as observed scores for A were generated.

The populations P and Q were combined to produce the synthetic form $T = wP + (1 - w)Q$, (Braun & Holland, 1982) where $0 < w < 1$. Eleven different weights for w were used, ranging from 0 to 1 in increments of .1. For example when $w = 0$, $T = Q$ and when $w = 1$, $T = P$. When $w = 0.1$, T is the combination of a random sample of 10% from P and 90% from Q .

The data generation was carried out with SAS 9.1 (2002). Populations P and Q were created with 100,000 cases each. Every population T had 100,000 cases as well. The actual variances and reliabilities for X and Y were computed directly in each population T , because full information on X and Y was available for every case. Then the estimates of variances and reliabilities under the L3 and L3* assumptions were computed, using only information on X in P and information on Y in Q . These estimates were then compared with the actual values.

The linear equating functions of X to Y under L3 and under L3* across the various populations were computed and compared to the actual values. The Equating Root Mean Square Difference (RMSD) was also computed.

4. Results

Results are summarized in Figures 1 to 7. Figure 1 displays the results for the estimation of the reliability of test X . According to this graph, the estimation of reliability under the traditional assumption L3 is closer to the actual reliability of test X . As the weight on P approaches 1 (i.e. T becomes more similar to P) the estimated reliabilities under the L3 and L3*

assumptions get closer to the true reliability of X . The reason for this trend should be obvious: The estimation procedure uses the full information on X available only in P . If $T = P$, then no estimation is necessary.

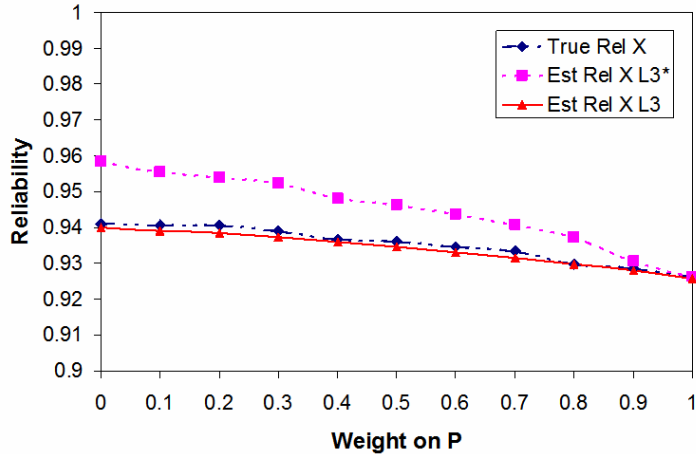


Figure 1. Estimated Reliability for Test X under assumptions L3 and L3*, compared with the actual reliability of X.

Figure 2 displays the results for the estimation of reliability of test Y . According to this graph, the estimation of reliability under the traditional assumption L3 is closer to the actual reliability of test Y . As the weight on P approaches 0 (i.e. T becomes more similar to Q) the estimated reliabilities under L3 and L3* get closer to the actual reliability of Y .

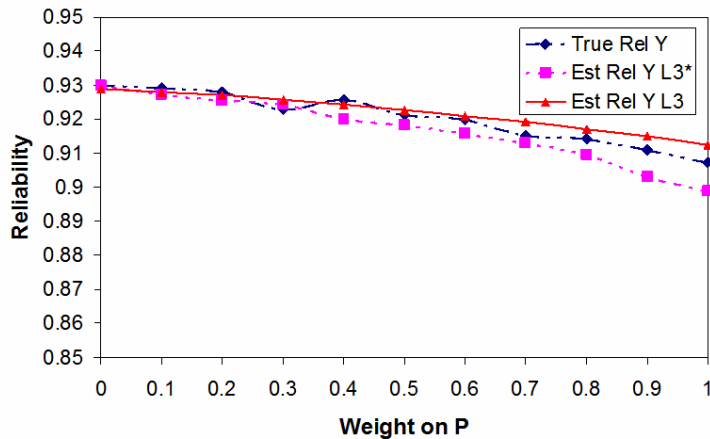


Figure 2. Estimated Reliability for Test Y under assumptions L3 and L3*, compared with the actual reliability of Y.

Figure 3 shows the results for the estimation of variance of test X . The estimation of variances under $L3^*$ appears to be slightly better than the estimation under $L3$. As the weight on P approaches 1, the estimation under both $L3$ and $L3^*$ gets closer to the actual value of the variance.

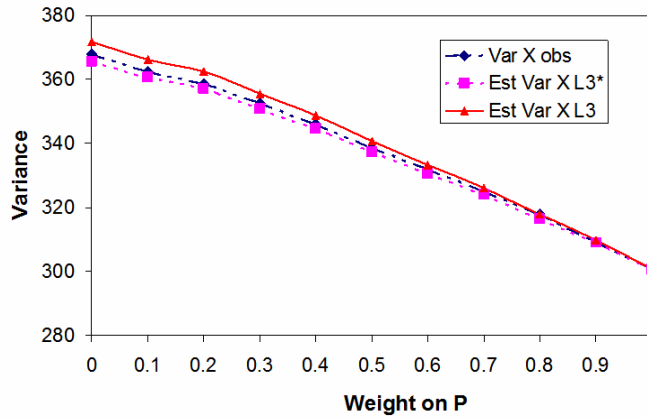


Figure 3. Estimated Observed Score Variance for Test X, under Assumption $L3$ Versus $L3^*$ Compared with Actual Variance.

Figure 4 shows the results for the estimation of variances of test Y . The estimation under both assumptions appears to be very close to the true variance in most of the range of weight on P . When the weight gets closer to 1 the estimation under $L3$ appears to be slightly better than the estimation under $L3^*$.

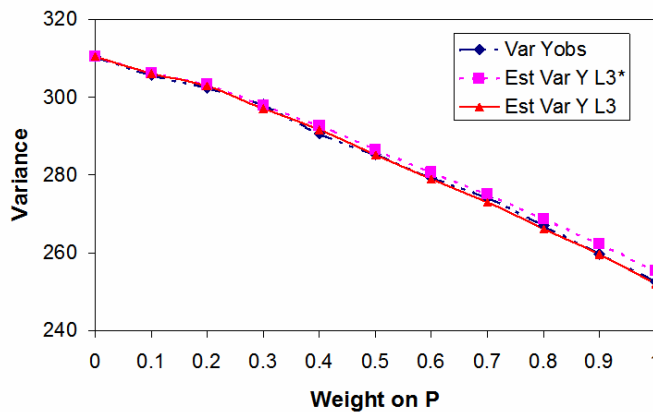


Figure 4. Estimated Observed Score Variance for Test Y under Assumption $L3$ Versus $L3^*$, Compared with Actual Variance.

Figure 5 presents the estimated α (linear equating slope for equating X to Y) under assumption L3 versus L3*, compared with actual α . According to this graph, for the lower range of weight on P the estimation under L3* appears to be closer to the actual α value while for the upper range of weight on P the opposite occurs. In the middle range of weight on P , L3 appears to perform slightly better than the estimation under L3*.

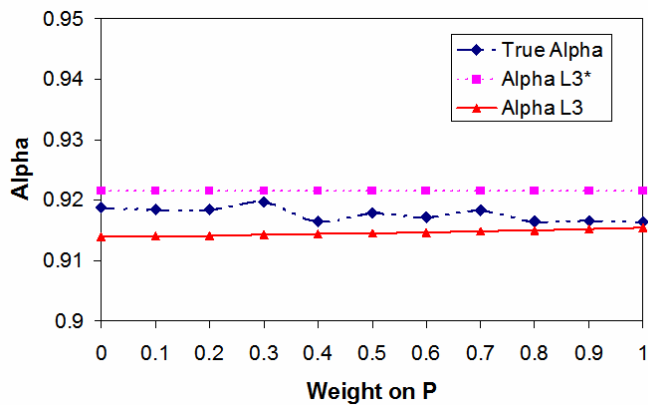


Figure 5. Estimated α (Linear Equating Slope for Equating X to Y) under Assumption L3 Versus L3*, Compared with Actual α .

Figure 6 shows the estimated β (linear equating intercept for equating X to Y) under assumption L3 versus L3*, compared with actual β . According to this graph it appears that the estimation under L3 is better than the estimation under L3*.

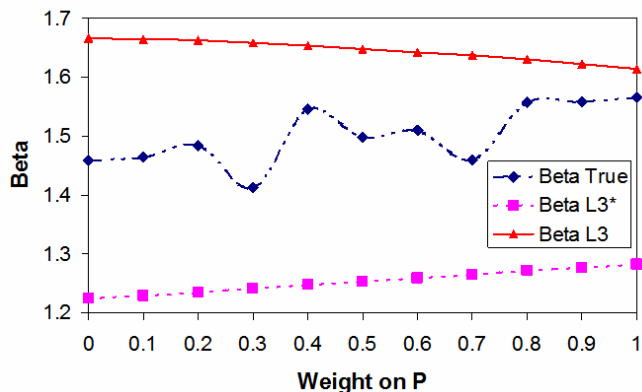


Figure 6. Estimated β (Linear Equating Intercept for Equating X to Y) under Assumption L3 Versus L3*, Compared with Actual β .

To have an idea of the practical difference in the estimation between L3 and L3* Figure 7 displays a particular case ($.4P + .6Q$) for the difference in the estimated X to Y equating function values under assumption L3 versus L3*, compared with actual equating function values.

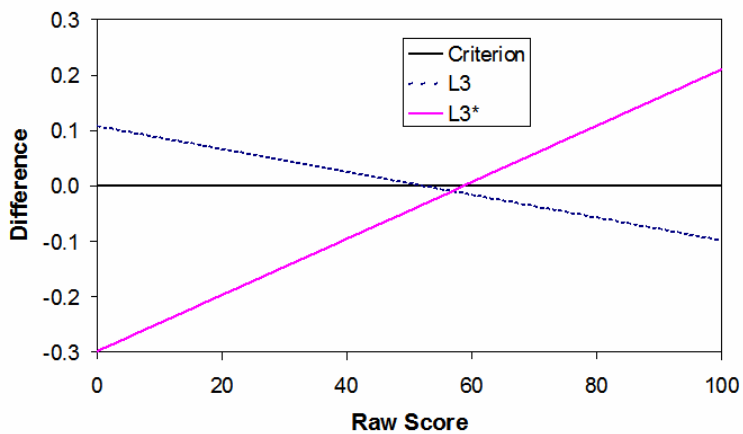


Figure 7. Difference in the Estimated X to Y Equating Function Values under Assumption L3 Versus L3*, Compared with Actual Equating Function for the case $.4P + .6Q$

This graph shows that for the difference is smaller for the L3 estimation. However even the biggest difference of 0.3 for a raw score close to 0 is of no practical significance, given that it is not expected to result in a change in actual reported score. Dorans and Feigenbaum (1994) proposed the notion of the “Difference That Matters” (DTM), defined as half a reported score unit, to judge the practical importance of a difference in unrounded equated scores. If the unrounded difference between two sets of equating results is less than the DTM, the authors argued, then both sets of scores should round to the same values. Because the differences here are all less than the DTM of 0.5, they can be considered inconsequential for all practical purposes.

To have an idea of what the magnitude of the difference is across all the weights on P , Figure 8 shows the equating root mean square difference (RMSD) values under assumption L3 versus L3*. Again differences in both estimations appear to be of no practical significance, as they are less than the DTM of 0.5.

5. Discussion and Conclusion

Although several recent studies (Albano, 2016, Elosua & Hambleton 2018, Akin, 2019, Gübes & Uyar, 2020, Wang et al, 2020) have looked into the score comparability through different equating techniques none of them have compared the assumption of the constant reliability ratio ($L3^*$) to the traditional assumption of constant error variance ($L3$) in the Levine method of equating. Albano (2016) reviewed various methods for applying them to nonequivalent groups. Elosua & Hambleton (2018) studied the effect of combining differential item functioning and test equating to achieve a higher score comparability. Akin (2019) compared different Kernel equating methods with designs based on the Non-Equivalent groups with Anchor Test Design (NEAT). Gübes & Uyar (2020) studied the effect of the presence of differential item functioning into the equating function and they found little differences when DIF is present. Wang et al (2020) looked at the effects of test length and sample size in the equating for non-equivalent groups.

Given the conditions set in this study, estimation from the traditional assumption $L3$ appeared to be closer to the estimation from the alternative $L3^*$. However, the RSMD indicates that the differences are not of practical significance given that these differences are not expected to result in a change in actual reported scores.

The educational implication of this study resides in the evaluation of the usually untestable invariance assumptions inherent in NEAT equating. Knowing the effect of these assumptions in the calculation of the equating function is of special interest for practitioners when choosing the method to be used.

This study examined the operation of certain assumptions in the context of the NEAT design under very specific conditions. Linear NEAT equating methodology could benefit from extensions of this research that examined other conditions such as:

- a) A larger difference in ability between populations P and Q . This is controlled by the distributions N (mean, variance) used to generate the anchor test scores in populations P and Q .
- b) A larger difference in difficulty between tests P and Q . This is controlled by the choice of a, b, c, d .
- c) Use of a different model to generate error scores besides the binomial error model.
- d) Use of non-normal distributions of total and anchor test scores.

Further studies should focus on these additional conditions. This study and further studies should help practitioners on deciding what equating methods utilize, especially when different versions of a test are administered.

References

- Akin-Arikan, C. (2019). A Comparison of Kernel Equating Methods Based on NEAT Design. *Eurasian Journal of Educational Research*, 82, 27-44. doi: 10.14689/ejer.2019.82.2
- Albano, A (2016). equate: An R Package for Observed-Score Linking and Equating. *Journal of Statistical Software*, 74. doi: 10.18637/jss.v074.i08
- Angoff, W. A. (1971). Scales, norms, and equivalent scores. In R. L. Thorndike (Ed.), *Educational measurement* (2nd ed., pp. 508-600) Washington, DC: American Council on Education. Reprinted as Angoff, W. H. (1984). *Scales, norms, and equivalent scores*, Princeton, NJ: Educational Testing Service.
- Braun, H. I., & Holland, P. W. (1982). Observed-score test equating: A mathematical analysis of some ETS equating procedures. In P. W. Holland & D. B. Rubin (Eds.), *Test equating* (pp. 9-49). New York: Academic Press.
- Dorans, N. J., & Feigenbaum, M. D. (1994). *Equating issues engendered by changes to the SAT and PSAT/NMSQT* (ETS Research Memorandum 94-10). Princeton, NJ: Educational Testing Service.
- Elosua, P., & Hambleton, R. (2018). Psychological and Educational Test Score Comparability across Groups in the Presence of Item Bias, *Journal of Psychology and Education*, 13(1), 23-32. doi: 10.23923/rpye2018.01.155
- Gübes, N., & Uyar, S. (2020). Comparing Performance of Different Equating Methods in Presence and Absence of DIF Items in Anchor Test. *International Journal of Progressive Education*, 16(3), 111-122. doi: 10.29329/ijpe.2020.248.8
- Holland, P. W. (2004). *Three methods of linear equating for the NEAT design*. Unpublished manuscript. Princeton, NJ: Educational Testing Service.
- Holland P. W. & Walker, M. (2006). *Notes on Angoff's estimates of the true score slope in Levine's Observed Score Equating function*. Unpublished Manuscript. Princeton, NJ: Educational Testing Service.
- Kolen, M. J., & Brennan, R. J. (2014). *Test Equating: Methods and practices* (3rd ed.). New York: Springer.
- Levine, R. (1955). *Equating the score scales of alternate forms administered to samples of different ability* (Research Bulletin 55-23). Princeton, NJ: Educational Testing Service.
- Lord, F. M., & Novick, M. R. (1968). *Statistical theories of mental test scores*. Reading, MA: Addison-Wesley.
- Petersen, N. S., Kolen, M. J., & Hoover, H. D. (1989). Scaling, norming, and equating. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 221-262). New York: Macmillan.

- Wang, S., Z., & You, S. (2020). A Comparison of IRT Observed Score Kernel Equating and Several Equating Methods. *Frontiers in Psychology, 11*, 308. doi:10.3389/fpsyg.2020.00308
- SAS Institute. (2002). *SAS/STAT software. Version 9.1* [Computer software]. Cary, NC: SAS Institute.



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Itineraries of Community Insertion of Foreign Unaccompanied Minors in Spain: Social and Educational Approach

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Abstract: Spain's current migratory profile corresponds to that of a country that receives migrants. Since the end of the 20th century, the number of foreign unaccompanied minors has increased. These minors have access to a social protection regime from the moment they are identified in Spanish territory until they reach the age of majority, at which point they acquire the status of former foster youth. The present research analyzes the transition of former foster youths to adult life after the cessation of the protection regime. The main objective is to determine the devices and resources currently to facilitate the entire social and labor insertion of unaccompanied foreign minors. The approach to the object of study has been developed from a qualitative methodology through in-depth interviews with privileged agents working in institutions that care for former foster children. The results obtained show that most of the unaccompanied foreign minors and former foster youth are in illegality. In the absence of a social protection system that protects them after they come of age, the possibility of accessing housing resources and/or training programs that allow them to continue with the development of an insertion itinerary is reduced, finding themselves in a situation of social risk, vulnerability and/or social exclusion, without adequate protection and shelter from the competent public administration.

Key Words: unaccompanied foreign minors; social protection; education; labor insertion; educational system; social work.

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1. Introduction

The Spanish state occupies a key position within the migratory routes and faces the need to control migratory flows and the urgency of implementing protection policies (Bravo and Santos-González, 2017). Migrants who frequent the Spanish territory traditionally tended to be adults or older people, while, around the nineties of the twentieth century, the presence of new actors, migrant minors, has been identified (Ortega, 2018).

Today's society pays attention to the phenomenon of migration, which is frequently addressed, both in the media and politically and socially, insisting on delving into this issue from the perspective of the "immigration problem" rather than from the perspective of "immigration" (Pedreño and Pedreño, 2005; Rinken, 2015). Specifically, we are aware of a tendency to refer to minors and young migrants in Spanish territory, which means that this group has become a social issue of great interest, both for public opinion and for the political and governmental spheres.

Recently, and with increasing intensity and frequency, there has been a discourse of rejection towards immigrants in general and unaccompanied foreign minors in particular (De Oliveira et al., 2005; D'Ancona, 2015). This is because current society establishes a causal relationship between the migrant collective and all those social situations that generate unease, uncertainty, and fear on Spanish citizenship (Ruiz-Aranguren and Cantalapiedra, 2018). This leads to the contamination of migrants' image when society's problematic situations are primarily due to more structural causes. However, the immigrant is the figure to attribute the problems that concern them, even generating hate speeches and situations worthy of arousing great concern.

The migratory phenomenon known as unaccompanied foreign minors (after this, MENAS) acquires a significant presence in the public space at the end of the first decade of the 21st century. These are migrant minors who, faced with the impossibility of achieving an optimal future in their respective countries of origin, find in the migratory process towards Western and European countries (often idealized) the only and great hope for their future. Thus, migration becomes, for many, a panacea, ignoring or ignoring the associated problems that can result from the migration process because it is a radical change capable of generating high levels of stress and tension that can even lead to migratory mourning. In addition, they are exposed to suffer the commonly known "Ulysses Syndrome" (Achetegui, 2008, Achetegui 2012), which corresponds to the chronic and multiple stress experienced by young migrants when they experience many problems (forced separation from loved ones, lack of opportunities, undocumented status, not finding work or working in conditions of risk or labor exploitation, struggle for survival, situations of

fear and helplessness, etc.) that multiply, lengthen and increase in difficulty over time.

Spanish legislation regulates a system of social protection for the group of MENAS, which will cease at the precise moment in which migrants turn eighteen years of age, remaining outside the social protection system and being expelled from the very device of accommodation in which they are. For this reason, it is justified to focus the object of research on exploring the situation of young migrants who reach the age of majority.

According to youth studies, this vital stage is defined as a process through which age is a social construction, institutionalized and subject to cultural legitimization according to a specific historical context (Sepúlveda, 2013; Sirignano et al., 2015). It involves the evolution from the total dependence of childhood to the complete independence of adulthood. The juvenile stage covers a variable length, depending on individual, contextual, cultural, and normative circumstances in preparation for the assumption of adult life. This is an extremely important issue that must be addressed through practice as well as research. The university, in this sense, can also contribute a lot about the knowledge of the problem (MacFadden, Gómez Galán, & Olmedo, 2020; Mac Fadden, I., López Meneses, Sarasola., & Gómez Galán, 2020).

In the case of minors and young migrants, there are significant shortcomings in their support during the transition to adulthood (Wade, 2011). On many occasions, they are forced to face youth lacking protection and social, family, and even institutional disengagement. In addition, once they reach the age of majority, former foster youth are no longer considered minors for legal purposes when their actual social situation does not vary significantly. They are legally considered and treated as an adult immigrant, bypassing the transition period to adulthood.

Many countries are affected by various difficulties that give rise to migratory flows (IOM, 2018). Now more than ever, these difficulties are provoked and reinforced, and even aggravated by the process of globalization. Spain is integrated into the frame of reference of the era of economic globalization, rather than humanizing globalization since we are facing a context that promotes the free flow of capital and goods while limiting the mobility of human beings who intend to settle in other countries (Brunet and Pizzi, 2011).

All migration will involve a migrant, understood as any person who moves across an international border or within a country, away from their usual place of residence regardless of their legal status, the voluntary or involuntary nature of the movement, the causes of the movement, or the duration of their stay (IOM, 2018). Therefore, the term "migrant" refers in its entirety to any person who moves from his or her country of origin to another country, regardless of that person's age. Therefore, we must not forget that it

includes minors who are part of global migration flows, acquiring the dual status of migrants and minors.

Currently, the MENAS collective is becoming an issue of concern for Spanish authorities, both state and regional (Vinaixa, 2019). MENAS are those people under 18 years of age, who migrate without the company of adult guardians and irregularly, motivated by situations of abuse, abandonment, poverty, family conflicts, and socio-familial and media influence on Europe, from a geographical area with poverty, high levels of unemployment, etc., (country of origin) to another whose image is that of the land of opportunities, in search of a better quality of life (Mohamed-Abderrahman, Ruiz and Vilà, 2018, p.88).

Concerning the most frequent age range among MENAS arriving in Spanish territory, it ranges between 14 and 17 years of age, although the presence of younger and younger minors is beginning to be noted (Save the Children, 2018). About the gender issue of MENAS, there is a very low and, on many occasions, non-existent representation of the female sex in the group.

Regarding the most frequent origin of the MENAS who are in Spanish territory, Moroccan origin is identified, as well as from other Maghreb countries, such as Algeria and, increasingly, we attend to the arrival of minors from sub-Saharan African countries, such as Senegal, Ghana or Nigeria and from South America and Eastern European countries (Ortega, 2018).

The MENAS found in Spanish territory "do not form a homogeneous group although they have some common features" (López, 2018, p. 73). Instead, they present a multitude and diversity of causes or motives that underlie the migration process carried out. Similarly, these minors experience a wide variety of situations once they settle in Spanish territory. UNICEF (2011) alludes to the diversity of reasons behind the migration of a minor, without the company of a reference adult:

[many children and adolescents decide to migrate unaccompanied by parents or guardians, either as part of a family survival strategy, in pursuit of personal goals, in search of their parents, to gain independence, or as part of a transition process to adulthood. Some also migrate to escape abuse and/or violence in the home or to escape early marriage, and issues related to economic or health problems in the family may also cause migration (UNICEF, 2011, p. 23-24).

These children and young people show great diversity and, like Ruiz, De las Olas and Vives (2019) point out, it is precisely this heterogeneity, both in terms of origins and migratory objectives and strategies, which leads to and increases the appearance of difficulties when it comes to making decisions regarding the institutional regulation of the migratory flow. In the absence of a consolidated social protection regime aimed at young migrants formerly under guardianship who are going through the transition to adulthood; in its absence, there are programs aimed at the group of people in a situation of

social exclusion, without prejudice to the fact that these programs present significant differences between communities (Bravo-Santos-González, 2017).

2. Legal and Administrative Regime for MENAS in Spain

2.1. Administrative situation of MENAS

In assigning the designation of MENAS, the identification carried out by the competent authority is essential. Regarding the registration of MENAS in Spanish territory, the National Police Force indicates that all MENAS who have been located in the national territory will be registered in the Register of Unaccompanied Foreign Minors (after this, RMENA), for the exclusive purpose of identification and location, following Article 215 of the Regulation on Foreigners (RD 557/2011). Registration in this registry requires the verification of the minor age of the presumed minors and the non-repatriation of the minor. All those young people registered in RMENA will be integrated into the social protection regime offered by the Spanish State, which is materialized in the assumption of Guardianship of these minors by the Public Administration, enjoying extensive legal and social protection. The number of minors registered in the foster care system has increased and has become one of the significant challenges in social affairs.

Migrant minors will enjoy this Protection System until they reach the age of majority, without the Spanish State contemplating any type of measure or protection for those who reach the age of majority. This is because "the principle of the best interests of the minor has an expiration date, that is to say, it is automatically deactivated from the moment the minor reaches 18 years of age" (Vinaixa, 2019, p. 5).

After reaching the age of majority, young people formerly in care find themselves in a situation characterized, in the first place, by the expulsion of the residential resource in which they are, being immersed in a situation of vulnerability that can be materialized in different situations. Often they will find themselves in a situation of illegality and will have no other option but to remain in a street situation without the possibility of accessing a legal job. On rare occasions, they will have the possibility of accessing and enjoying social assistance. Thus, a double condition of these young people can be seen, which is a paradox. On the one hand, they are minors who must be protected, considering them victims of a situation that exceeds them and, on the other hand, they are foreigners in an irregular situation, the reason for which they are conceived as a problem of public order (López, 2018).

The legislative system that ceases the offer of Social Protection aimed at MENAS is the same one that, in parallel and contrary, restricts and limits the possibilities of access to the labor market and to specific resources necessary to guarantee personal autonomy and socio-labor integration. This fact does not cease to be a contradiction between the legislative framework

and the social protection system leaving in an administrative and competence limbo, especially with structures and services of response to these immigrant minors without support from their families of origin.

2.2. Regulatory regime for MENAS

Within the community context, several regulations make allusions to Childhood. The most outstanding are: 1) The European Convention of Rome in 1950, for the Protection of Human Rights and Fundamental Freedoms, 2) The European Social Charter of 1961 of Turin, ratified by Spain in 1980, 3) The European Social Charter of 1965 and 4) The European Charter of the Rights of the Child, of 8 July 1992.

Since the MENAS phenomenon affects the European Union, in general, and the Spanish territory, in particular, the Spanish Government assumes the responsibility and need to regulate this group and guarantee the best interests of minors when regulating migratory flows. The state regulation adopts a position oriented towards the concern for all minors in general, without attending to the regulation of MENAS in particular (European Migration Network, 2018). State regulations regulate that "a MENA is entitled to the protection of the Spanish State under the same conditions as Spanish minors, regardless of the place of his or her birth" (Save the Children, 2018). It is worth looking at the fundamental regulations which make up the state legislation on the issue addressed (Table 1).

Regulations	Content
Spanish Constitution (EC)	<p>Art. 13.1 Establishes that foreigners shall enjoy the public freedoms guaranteed by Title I.</p> <p>It establishes the obligation of the public authorities to ensure the social, economic, and legal protection of the family, especially minors, following international agreements that safeguard their rights.</p> <p>Art. 149. Determines the exclusive competence of the State to regulate in matters of Nationality, Immigration, Emigration, Aliens, and Right of Asylum.</p>
Law 4/2000 of 11 January 2000 on the rights and freedoms of foreigners in Spain.	<p>This law aims to regulate the foreign population residing in Spain to stay for work purposes.</p> <p>Art. 35. Unaccompanied Minors.</p> <p>Art. 35.3. A regime of guardianship is automatically activated on the part of the Administration towards the MENAS.</p> <p>Art. 35.7. "The residence of minors under guardianship shall be considered regular for all purposes [...] at the request of the body exercising guardianship, and once the impossibility of returning to their family or country of origin has been accredited, the minor shall be granted a residence permit, the effects of which shall be retroactive to the time when the minor was placed at the disposal of the services for the protection of minors. The absence of a residence permit shall not prevent the recognition and enjoyment of all the rights to</p>

	<p>which he or she is entitled as a minor".</p> <p>Art. 35.8. "The granting of a residence permit shall not be an obstacle to subsequent repatriation when it is in the best interests of the minor, under the terms established in the fourth paragraph of this article".</p> <p>Art. 62. Concerning Repatriation</p> <p>Art. 197.4. The residence permit renewal shall be valid for two years, once the MENA acquires it during minority.</p>
Organic Law 1/1996, of 15 January 1996, on the Legal Protection of Minors, partially amending the Civil Code and the Civil Procedure Law	<p>Partially repealed law</p> <p>Art. 2. Defends the child's best interests, recognizing the right to evaluate and weigh the totality of his or her interests when adopting a measure concerning him or her. If a legal provision can be interpreted in different ways, the interpretation that best serves the child's interests shall be chosen.</p> <p>Art 10.4. "When the Public Entity assumes the guardianship of a foreign minor who is in Spain, the General State Administration will provide [...] the documentation accrediting his/her situation and the residence permit, once the impossibility of returning to his/her family or country of origin has been accredited [...]".</p> <p>Art. 12.4. "When the age of majority of a person cannot be established, he or she shall be considered a minor for the provisions of this Act, pending determination of his or her age".</p> <p>Chapter IV. Specific Protection Centres for minors with behavioral problems. The imposition of security measures and restriction of freedoms or fundamental rights is envisaged as a last resort.</p>
Organic Law 8/2015, of 22 July, on the modification of the system to protect children and adolescents.	<p>The first law at the state level establishes that minors (including MENAS) must be supported or accompanied during the transition to adult life. It does not specify up to what age or how this support will be provided.</p>
Law 26/2015, of 28 July, on the Protection of Children and Adolescents.	<p>Art. 2. Best interests of the child</p> <p>Art. 9. Right to be heard and to be listened to</p> <p>Art. 12.1. "The protection of minors by the public authorities shall be carried out through the prevention, detection, and reparation of situations of risk, with the establishment of appropriate services and resources for this purpose, the exercise of guardianship and, in cases of declaration of abandonment, the assumption of guardianship [...]. In protection actions, in all cases, family measures shall take precedence over residential measures, stable measures over temporary measures, and consensual measures over imposed measures".</p>

Table 1. Most relevant legal regulations on MENA in Spain. Source: BOE, own elaboration.

3. Methods

The object of study of this research is the real possibilities of social and labor insertion of young people formerly under guardianship and to know the existing devices when intervening with these young people. With this, an approximation of this phenomenon within the current Social Policy is carried out to make proposals for improvement in the intervention of social workers linked directly or indirectly with the group in question.

Within this framework, the general objective of the research is: to analyze the devices, possibilities, strategies, and actions currently existing in the social protection system to achieve the socio-labor insertion of MENAS and young people formerly under guardianship in the context of the health crisis derived from the COVID-19.

This is a qualitative case study and a descriptive, hermeneutic phenomenological methodology because it leads to the description and interpretation of the essence of the lived experiences and recognizes the importance of the collected experience (Fuster, 2019). This decision is based on the interest in knowing and trying to explain the issue that concerns us based on the professionals' discourse who intervene with MENAS and with young people formerly under guardianship.

The study was carried out in the Region of Murcia, given that it is one of the Autonomous Communities that receive the most significant number of MENAS due to its geographical location, especially those who migrate using small boats from North Africa.

Access to participants was based on purposive sampling, as a deliberate choice was made to select individuals from the population. It is a network or "snowball" type of sampling since "a series of initial informants have been asked to provide the names of other potential members of the sample who form part of the special population" (Alaminos, Castejón, 2006, p. 53). The expert knowledge acquires the interest. Therefore five interviews were conducted with privileged actors. Three social work professionals and two psychology professionals were selected, whose narratives and discourses acquire extraordinary transcendence due to their closeness and professional contact with the social reality addressed. The social actors relate to different social entities. Three different entities are differentiated (Table 2).

E1	Social Worker at the Centre for the protection of minors Ankasó.
E2	Psychologist of the Protection Centre of the medium and long stay of MENAS Ankasó.
E3	Social Worker of the Caritas Diocese of Cartagena's Shelter Homes Programme.
E4	Psychologist of the Caritas Diocese of Cartagena's Shelter Homes Program.

E5	Social Worker of the Programme of socio-educational accompaniment to young people formerly under guardianship and/or at social risk of the Red Cross for young people between 16 and 23 years of age.
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Table 2. Professional profile of the participants in the interviews

The technique used was the in-depth interview, carried out employing a script of questions previously established based on the objective to be achieved. It is a structured interview made up of standardized and open questions, which has been implemented telematically. Subsequently, the information was collected through the transcription of the interviews that were initially recorded with the prior authorization of the participants.

In order to carry out the qualitative analysis, an *ad hoc* hermeneutic unit was created in the program Atlas.ti, composed of five primary documents related to the structured in-depth interviews carried out, which addressed the following key elements: 1) Situation of MENA, 2) Situation of former foster youth, 3) Possibilities of access to a Protection System for former foster youth, 4) Assessment of the current situation of former foster youth, 5) Aspects to improve to facilitate the socio-labor insertion of former foster youth, 6) Scope of the social and health crisis caused by COVID-19 on the future of former foster youth.

Once the interviews were implemented, a grouping by families was carried out to distinguish the primary documents between the professionals who intervene with the MENAS group and the professionals who intervene with the group of young people formerly under guardianship.

After a first reading of the interviews, a series of codes are determined: 1) insertion itinerary, 2) techniques and resources, 3) areas of action, 4) main difficulties, 5) access to resources, 6) protection system for young people formerly in care, 7) administrative procedures, 8) documentation, 9) obtaining a work permit, 10) legal situation, 11) unfair situation, 12) proposals for improving insertion, 13) accommodation arrangements, 14) training programs, 15) lack of protection for young people formerly in care, 16) COVID-19 effects.

The data of interest reached are distributed in three blocks: the current situation of MENAS in terms of living conditions, the situation of young people formerly under guardianship and possibilities of labor insertion and, thirdly, the effects caused by COVID-19 on this group.

4. Discourse Analysis of Social Actors

4.1. Main areas of action with MENAS

The procedure of professional intervention with the MENAS group acquires a comprehensive, holistic, and transversal intervention modality. All

of those interviewed identified four fundamental areas of action: the educational, training, social, and labor spheres. The professionals intervene in all of them from the minor's arrival and throughout their stay in the center. The social actors identify the child's length of stay in the center as a critical factor in intervening with greater or lesser frequency and/or intensity in each area mentioned above.

It depends a lot on how long the child has been at home, since, with newly arrived children, the main area to work on is primarily training and education. (E1)

All of the people interviewed to identify the educational sphere as the main one, equating it with the Spanish language's learning and control, as it conditions the effective intervention on the rest of the spheres. However, the interviewees emphasize that there is not a complete dedication to intervention in the educational sphere, but that intervention in the educational sphere acquires interest in a parallel and simultaneous way.

Most children who arrive lack social skills and rules, so working in the educational field is essential. (E1)

When the MENAS shows some progress in both areas, the intervention in the labor area will be carried out.

When they have already acquired a level of Spanish, they have already completed a training course; we intervene with them in the work environment to guide them towards independence. (E1)

4.2. Main difficulties for the full integration of MENAS

The demonstrators converge in identifying the main difficulties, the language barrier, the difficulties at school, and the difficulties encountered in terms of cultural and social adaptation and the acceptance of norms. They insist on the question of the language barrier as the main one and the one that implies the most significant difficulty, insofar as it hinders the socialization of minors.

Without a doubt, in the social sphere, the most severe difficulty we identify is the language barrier, as this makes it quite difficult for children to socialize. (E1)

In addition, the participants perceive the issue of regularization of the administrative situation as a persistent difficulty. Concerning the processing of documentation (passport, residence, and work permits), there are two significant problems: 1) long waiting periods, which result in a delay in the resolution of procedures, and 2) disorganization when obtaining documents, mainly the passport, which can take between 6-12 months, and which becomes an essential requirement when proceeding to process the residence permit.

Six months or a year can go by, which creates quite a lot of tension among the minors, as they see their coming of age coming soon and they still

do not have a passport, and therefore it affects their residency, which creates much frustration for them. (E1)

The agents interviewed allude to the current difficulty, not only at the time of obtaining the residence permit but also when it must be renewed. This difficulty is increased when, by a Supreme Court ruling, the possibility of social entities being able to accredit the guarantee of basic needs of minors and young migrants through a Social Report from the social worker was annulled. Following this ruling, it became a fundamental requirement for minors and/or young people to prove their financial means in order to be able to renew their residence permits.

Complicated issue, if they do not have a work permit and cannot get someone to hire and process it. (E5)

The participants, in turn, refer to the fact that this situation of difficulty related to obtaining a work permit, in many cases, leads young people to engage in activities that are not permitted as the only way to obtain economic income.

Due to the difficulty in obtaining a work permit, it has been observed that some users are forced to earn income in activities that are not permitted (gorrillas). (E5)

The participants identify health coverage as a difficulty, pointing out that they will only have access to temporary health coverage and that this will be linked to the availability of a job or first-degree family with Spanish nationality.

In addition, social actors point to the issue of migration expectations as a difficulty.

[...] the migratory expectations come from, which do not coincide with the current reality, primarily caused by the call effect. There is little reality in the time and patience that has to be invested in this migratory process. (E4)

On the other hand, the participant's value as a difficulty the situation related to the lack of protection when these minors reach the age of majority.

Another problem could also be the issue of temporary accommodation when they reach the age of majority they do not have a residence, they have been in Spain for a short time [...] so the associations do not take them and then this issue is quite complicated, as they are left on the street as illegal, in the end. (E1)

4.3. Assessment of the current situation and proposals to facilitate the socio-occupational integration of MENAS

Referring to the current situation of MENAS, the participants define it as a "complicated" situation and identify it as a "handicap" specific governmental actions or omissions that may derive or derive from the influence of the beliefs and/or stigmas that society, in general, assumes towards this group.

At present, the current situation of unaccompanied minors is complicated, as the government puts more and more obstacles in working, the thinking and beliefs of citizens, and the minors' attitudes and beliefs. (E2)

In assessing the current situation, the social actors identify the following key issues: 1) excellent saturation in the protection centers, 2) difficulties in carrying out an individualized project with minors, 3) the high number of minors who demand attention together with the scarcity of human resources and 4) the agglomeration of procedures related to the processing of documents (passport, cell, residence permit) and formalities (registration, health care, etc.), work that must be combined with direct attention to the minor.

Regarding the proposals for improvement to facilitate the socio-occupational integration of MENA, the discourses of the agents interviewed highlight the need to develop and implement a more significant number of resources, projects, and programs for young ex tutees (temporary accommodation, training programs, and projects) and the need to increase coordination between social entities and the Public Administration, at all levels, as well as between the professionals of the shelters for MENAS.

There should be more resources, projects, and programs for young people formerly in care and greater coordination between social entities and administration at the local, regional, and national levels. (E1)

4.4. Possibilities of access to the protection system for young people formerly in care

The discourse and narratives offered by the participants allude to the non-existence of a formalized protection system as such for former foster youth.

So, as a Protection System, actually, at present, when they turn eighteen, there is none. (E1)

Thus, when minors reach the age of majority, they are obliged to leave the facility where they are staying immediately. All the interviewees pointed out that, in practice, it is possible to differentiate between two situations at the moment of reaching the age of majority: 1) acquisition of the required legal documentation (passport, cell, residence permit) and 2) non-acquisition of such documentation.

In the case of lacking documentation, once they reach 18 years of age, they will find themselves in illegality. They will only have the possibility of accessing resources for people in situations of vulnerability or social exclusion (supervised flats, social shelters, protection service for refugees) as an alternative to remaining in a street situation, remaining under the protection of certain institutions that intervene with the group of people in street situations and vulnerability.

In most cases, children who do not have documentation go directly to the street. (E2)

In reaching the age of majority with the necessary documentation, the situation will be somewhat more beneficial. However, even in this case, they will not enjoy full social and labor integration, and there will be a lack of protection.

In this case, from the Reception Centres, the professionals coordinate with the relevant entities to refer the minor to temporary accommodation resources and/or training programs to which young people formerly in care can have access. They will have to wait for places to become available.

As a general rule, the shelters for MENAS have agreements and the capacity for coordination, communication, and collaboration with different associations and entities that intervene, in one way or another, in the field of protection of young migrants. The interviewees point to the existence of an agreement with Caritas.

If Caritas lacks free places, they will try to find alternative resources by coordinating with other entities.

From Cruz Roja Murcia, we have one emancipation flat with six mixed places, destined to young people formerly under guardianship and/or at risk of social exclusion, between 18 and 23 years old". (E5)

Based on the discourse of the social actors, a reality marked by the increase in the number of young people who try to access these resources can be appreciated, which results in the increasing number and rigidity of the requirements demanded by the entities, such as demanding the availability of documentation, a minimum period of stay in the reception center, etcetera.

It is precisely this tendency to increase and/or tighten the requirements for access to resources for young people formerly in care, due to the large volume of demand compared to the reduced supply of resources (both material and economic and human), which leads to problematic situations in practice.

The problem comes when the minors come to us, maybe at seventeen years of age, lack documentation, and lack many things that they ask for in Caritas, so they are left on the street. (E1)

It is widespread for minors to enter a shelter when they are very close to the age of majority, making it difficult, and in many cases impossible, to have the necessary documentation and/or to meet other requirements, which is the origin of a problematic situation.

When the young people formerly under guardianship manage to access accommodation resources and/or training programs because they meet the requirements and get a place, the professional intervention focuses on continuing with the integration itinerary previously established by the reception center where the minor has been, offering accompaniment, orienting them towards the need for training to facilitate their integration into the labor market and continuing with the management of the administrative regularisation procedures.

4.5. Access to housing facilities and training programs for former foster youths

Based on the discourse of the social actors, it is imperative to insist on the order of priority of needs when intervening with former foster youth. The coverage of the need for access to accommodation should prevail over the offer of training programs since it is counterproductive and ineffective to offer workshops and training programs to young people who are in a situation of homelessness, as it is difficult for them to have a physical, psychological and emotional state that allows and/or favors the willingness to attend and take advantage of a training resource.

Firstly, they must be provided with access to temporary accommodation, for which it will be necessary both to develop new devices that provide temporary accommodation (residential centers or supervised flats) and to improve the functioning of existing ones, increase the number of places available and/or increase the period allocated to the use of resources for each young person.

Secondly, once the basic need for accommodation has been covered, the development of programs aimed at increasing, reinforcing, and complementing the training of these young people and thus improving their employability, to find work in the short term, will be of great importance.

4.6. Assessment of the current situation of young people formerly under guardianship

The social actors consider that, at present, suitable and sufficient resources, devices, and programs are not implemented to meet the group's actual needs. They identify the lack of economic, material, and human resources as the main factor that hinders truly effective comprehensive care implementation. Furthermore, they value the current situation as complex due to the difficulties of insertion experienced by these young people. Thus, they refer to various factors that originate and influence the difficulties while at the same time highlighting them.

In the first place, a lack of resources is identified by attending to a high number of ex-custodial youths who cannot access accommodation resources due to a lack of means to meet all their demands. In the case of young people who have access to resources, there is a shortage for those who require a more specialized accompaniment, resulting in difficulty carrying out more individualized social interventions.

Secondly, the excessive workload is an obstacle since too few professionals are involved, who have to intervene directly with each young person and have to deal with a high volume of bureaucracy for each young person.

Thirdly, there is a minimum ratio of professional care per user. In the sense that the number of professionals in the accommodation facilities is too

tiny compared to many young people formerly in care, resulting in poorer quality professional care.

In a center, an educator can be the reference person for 4-6 MENAS [...] in the Caritas Diocese of Cartagena's program of Shelters–Murcia; we are one Coordinator, five care technicians, and one psychologist for 80 places. (E3)

Fourthly, it is possible to identify as difficulties the lack of tools to face a job interview, lack of language skills, difficulties to maintain constancy and responsibility. All of them should be worked on individually.

Fifthly, they allude to the various and numerous difficulties in reaching an employment contract that meets the conditions required by the Law on Foreigners to make it possible to obtain a work permit.

Sixthly, the social agents interviewed to identify the legal/administrative procedures necessary to obtain and/or renew the residence and/or work permits that will allow them to remain in Spanish territory in a legal situation as the fundamental factor that causes most of the difficulties experienced by the group in question.

4.7. Effects of the social and health crisis caused by COVID-19 on MENAS and young people formerly under guardianship.

The social and health crisis caused by COVID-19 has affected the functioning of the shelters for MENAS and the entities with which they are coordinated and the MENAS themselves and the young people formerly under guardianship.

Prevention and protection measures have been taken by the MENAS Reception Centre, both for minors and professionals. As for the protection measures adopted with the minors have been restricted from going outside, which has affected them emotionally and psychologically (symptoms of anxiety, nervousness, etc.). In short, they have experienced a loss of training resources and face added difficulties in the integration process due to the lengthening of documentation processing periods and losing or delaying access to academic and employment resources. As for the protection measures adopted with the workers have reduced the number of times they went to the center or the entities, combining them with teleworking.

Following the first wave of the pandemic, several negative repercussions are expected on the short and medium-term future of children and young people formerly in care, in general, and minors are coming of age at this time, in particular.

This situation affects two levels: 1) at the administrative level and 2) expectations and possibilities of social insertion of minors and young people. The processing of documents (passports, residence and work permits, etc.) and health care is paralyzed at the administrative level. At the level of the

minors and young people themselves, it mainly affects those who come of age in this socio-health context.

As for the young people formerly under guardianship who are integrated into an accommodation resource and/or emancipation flats, the situation of the state of alarm has affected them in the sense that it is not possible for the professionals to continue developing the process of accompaniment and face-to-face support, as is typically done, affecting the development of their insertion itinerary as well as the active search for employment, which is essential to be able to accredit their own and sufficient economic means to justify the possibility of renewing, in the coming months, the residence permit.

The interviewees describe the future of minors as "uncertain" and identify the negative consequences on the labor market as the significant impact. This is because the cancellation of training courses means the loss of the opportunity to acquire the knowledge imparted, carry out work experience, and, consequently, be known by companies that could hire them.

So, in the end, it is a problem because, by failing all the courses, they cannot continue training and, therefore, they cannot enter the labor market in the future. (E1)

About the effects of this crisis on the forecast arrival of new MENA, those interviewed consider that their arrival will be reduced due to the closure of borders.

4.8. Proposals to facilitate the socio-occupational integration of young people formerly under guardianship

The social actors offer a series of proposals aimed at improving the socio-labor integration of young people formerly under guardianship: 1) To move towards the development of a line of inclusion companies that favor the access of young ex-custodians to the labor market, 2) To facilitate the legal-administrative procedures in order that social organizations can prioritize the development and execution of an insertion itinerary for each young person, 3) To expand the offer of training programs aimed at young ex-custodians, 4) To increase the size of the ratio of technicians per user in each program, 5) To increase the availability of resources and/or their use, in order to enable individualized intervention, 6) Greater coordination between social entities and professionals.

5. Conclusions

Because of the results and their theoretical basis, we can see the latent need to address the demand of young people under guardianship and external by the public administration. When MENAS reaches the age of majority, they go from being considered minors to being directly treated as adults, ignoring

the period of transition to adult life in their youth stage in a social and family context of extreme difficulty and significant social vulnerability. Furthermore, it must be taken into account that these MENAS should be immersed and focused exclusively on the educational sphere, forging a future for themselves in society. However, they are involved in legal and administrative problems that can condition them for the rest of their lives negatively.

Within the professional practice of Social Work, there is a need to develop equipment and services aimed at providing more excellent social protection to this highly vulnerable group in order to facilitate the continuation of the insertion itineraries of young people formerly under guardianship, with training mainly from the educational field being one of its pillars.

About the research objective, a social protection system is in place whereby young people in juvenile detention benefit from various measures and are guaranteed a housing resource, regardless of their administrative situation. In contrast, young people formerly in care are not eligible for any of them if they are in a situation of illegality.

Concerning the intervention with MENAS, an upbeat assessment of the procedure currently implemented is obtained. Proposals for improvement are only observed in the area of training devices, considering it opportune to enrich the offer of training workshops and with the improvement of coordination both between professionals and between social entities.

About the intervention with young people formerly under guardianship, a lack of protection is detected when the MENAS reaches the age of majority. To cover the needs of this group, there are only scarce and limited resources unrelated to a social protection regime that can only be accessed in the case of being in a legal situation. Those who reach the age of majority illegally or who do not manage to renew their residence and/or work permits are excluded from these resources.

From the theoretical analysis and the discourses of the privileged agents, the declaration of the destitution of minors is identified as the central problematic situation in line with recent research (Vinaixa, 2019). In this line, it becomes possible to conclude with the idea that the main issue with the MENAS is not so much related to the strategies, approaches, areas, and/or the way of intervening once the external youngsters get one of the scarce existing places when accessing the available resources, but with the incapacity presented by the Social Policy to respond to the needs of the external youngsters, abandoning and removing from the social protection system those who are in a situation of illegality and offering resources that are too limited for those who are in a legal situation, having to meet increasingly more essential requirements, both in number and rigidity, precisely because of the scarcity of resources and limited supply.

On the other hand, alluding to the socio-health context derived from COVID-19, a negative short and medium-term effect on the future of the MENAS and young people in exile is foreseen, identifying a more significant effect on minors who reach or have reached the age of majority in this period.

As for the consequences on the young people themselves, on the one hand, the paralysis of the administrative procedures is detected, which means an increase in the delay in obtaining residence and/or work permits and, on the other hand, the training and labor insertion possibilities of these young people are conditioned by the cancellation of the training courses. As for the arrival of new MENAS, a reduction is expected in the short term.

In short, minors who reach the age of majority constitute one of the social groups with the most significant social vulnerability since any social protection system does not cover them - except some scarce complementary services from Social Services -, they are in a foreign country whose social and family networks are limited. On many occasions, problems of drug addiction, access to employment, delinquency, etc., are focused on them, highlighting the marginality and social exclusion of these young people. Networking (Martínez-López and Sánchez, 2019) through different coordinated initiatives such as those that took place after the economic crisis in Spain in 2008 emerges as essential for these minors. This will allow the establishment of social insertion itineraries that reverse the poor working conditions of immigrants in Spain (Gayo and Quintana, 2019).

Finally, one of the significant challenges of Social Work concerning this area of professional activity is to consolidate an approach that emphasizes the importance of generating an inclusive society, highlighting the need to face the challenge of the socio-labor integration of young migrants formerly under guardianship who are moving towards adult life in the host countries. To this end, an intervention is proposed that not only focuses on responding to their demands during their minority years but is projected in itineraries of social inclusion, community participation, and, above all, labor insertion from an integral and transversal perspective.

References

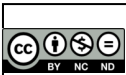
- Achotegui, J. (2008). Duelo migratorio extremo: El síndrome del inmigrante con estrés crónico y múltiple (Síndrome de Ulises). *Avances en Salud Mental Relacional*, 7(1), 15-25.
- Achotegui, J. (2012). Emigrar hoy en situaciones extremas. El Síndrome de Ulises. *Revista de Psicología, Ciències de l'Educació i de l'Esport*, 30(2), 79-86.
- ACNUR (1951). *Convención sobre el Estatuto de los Refugiados*. Retrieved from <https://www.acnur.org/5b0766944.pdf>.

- Alaminos, A., & Castejón, J. L. (2006). *Elaboración, análisis e interpretación de encuestas, cuestionarios y escalas de opinión*. Alicante: EEES - Editorial Marfil, S.A.
- BOE (1889). *Real Decreto de 24 de julio de 1889 por el que se publica el Código Civil*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-1889-4763>.
- BOE (1978). *Constitución Española*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-1978-31229>.
- BOE (1985). *Ley Orgánica 7/1985, de 1 de julio, sobre derechos y libertades de los extranjeros en España*. Retrieved from <https://www.boe.es/eli/es/lo/1985/07/01/7>.
- BOE (1996). *Ley Orgánica 1/1996, de 15 de enero, de Protección Jurídica del Menor, de modificación parcial del Código Civil y de la Ley de Enjuiciamiento Civil*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-1996-1069>.
- BOE (2000). *Ley y Orgánica 4/2000 sobre los Derechos y Libertades de los Extranjeros en España y su Integración Social*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-2000-544>.
- BOE (2003). *Ley Orgánica 14/2003, de 20 de noviembre, de Reforma de la Ley orgánica 4/2000, de 11 de enero, sobre derechos y libertades de los extranjeros en España y su integración social*. Retrieved from <https://www.boe.es/buscar/doc.php?id=BOE-A-2003-21187>.
- BOE (2011). *Real Decreto 557/2011 de 20 de abril por el que se aprueba el Reglamento de la Ley Orgánica 4/2000, sobre derechos y libertades de los extranjeros en España y su integración social*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-2011-7703>.
- BOE (2014). *Protocolo Marco sobre determinadas actuaciones en relación con los Menores Extranjeros No Acompañados*. Retrieved from <https://www.boe.es/buscar/doc.php?id=BOE-A-2014-10515>.
- BOE (2015). *Ley 26/2015, de 28 de julio, de modificación del sistema de protección a la infancia y a la adolescencia*. Retrieved from <https://www.boe.es/buscar/act.php?id=BOE-A-2015-8470>.
- Bravo, A., & Santos-González, I. (2017). Menores extranjeros no acompañados en España: necesidades y modelos de intervención. *Psychosocial Intervention*, 26(1), 55-62. doi: 10.1016/j.psi.2015.12.001
- Brunet, I., Pizzi, A. (2011). Teorías sobre migraciones y globalización. *Revista de gestión pública y privada*, 16, 7-32.
- D'Ancona, M. A. (2015). Los efectos de la crisis económica en la molduración y evolución de la opinión pública española ante la inmigración. *Migraciones. Publicación del Instituto Universitario de Estudios sobre Migraciones*, 37, 29-52.

- De Oliveira, D. R., Techio, E. M., Páez, D., & Herranz, K. (2005). Factores predictores de las actitudes ante la inmigración. *Revista de Psicología Social*, 20(1), 19-37.
- Fuster, D. (2019). Investigación cualitativa: Método fenomenológico hermenéutico. *Propósitos y Representaciones*, 7(1), 201-229. doi: 10.20511/pyr2019.v7n1.267.
- Gayo, G. M., & Quintana, V. M. (2019). La calidad del empleo de los trabajadores extranjeros en el mercado laboral español en época de crisis económica. *Sistema*, 253, 89-116.
- MacFadden, I., Gómez Galán, J., & Olmedo, E. O. (2020). Talleres socioeducativos como herramienta de desarrollo humano en barrios vulnerables. In VV.AA. *Claves para la innovación pedagógica ante los nuevos retos: respuestas en la vanguardia de la práctica educativa* (pp. 1750-1755). Barcelona: Octaedro.
- Mac Fadden, I., López Meneses, E., Sarasola, J. L., & Gómez Galán, J. (2020). *Reflections on Investigating the Complexity of Social Cohesion in the Era of Globalization*. Badajoz: Eurytion Press.
- Manzanera-Román, S., Hernández Pedreño, M., & Ortiz, P. (2019). Precariedad laboral y exclusión social en España: Hacia un nuevo modelo desprotector y de cohesión débil. *Revista de Ciencias Sociales*, 253, 35-56.
- Martínez-López, J., & Sánchez Carbonell, M. A. (2019). Nuevas respuestas a la pobreza y exclusión social desde el Trabajo Social: la Mesa de Instituciones Sociales en Acción Social de Elda (Mesa ISAE). *Cuadernos de Trabajo Social*, 32(2), 301-327. doi:10.5209/cuts.59106
- Mohamed-Abderrahman, J., Ruiz-Garzón, F., Vila-años, R. (2018). Historia de vida de un menor extranjero no acompañado de Melilla. *Revista Científica sobre Diversidad Cultural*, 2, 86-112.
- Pedreño, A., & Pedreño, M. (2005) *La condición inmigrante: exploraciones e investigaciones desde la Región de Murcia*. Murcia: Editum.
- Red Europea de Migración. (2018). *Estudio sobre el Régimen de los menores extranjeros no acompañados tras la determinación de su estatus*. Retrieved from https://ec.europa.eu/homeaffairs/sites/homeaffairs/files/26a_spain_uam_2017_final_en.pdf.
- Rinken, S. (2015). Actitudes hacia la inmigración y los inmigrantes: ¿en qué es España excepcional? *Migraciones. Publicación del Instituto Universitario de Estudios sobre Migraciones*, 37, 53-74.
- Ruiz-Aranguren, M., & Cantalapiedra, M. J. (2018). La inmigración en la esfera mediática: estrategias de actores políticos clave. *Comunicación y Sociedad*, 31(2), 87-100.
- Sirignano, F. M., Perillo, P., & Maddalena, S. (2015). Education and narration in intercultural perspective: Theories and interventions. *International Journal of Educational Excellence*, 1(1), 15-41. doi: 10.18562/ijee.01

UNICEF (2011). *La travesía. Migración e Infancia. Fondo de las Naciones Unidas para la Infancia*. Retrieved from <https://www.refworld.org/es/docid/5bd34e214.html>.

Wade, J. (2011). Preparation and transition planning for unaccompanied asylum-seeking and refugee young people: A review of evidence in England. *Children and Youth Services Review*, 33(12), 2424-2430. doi: 10.1016/j.childyouth.2011.08.027



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A Model of Interdisciplinary Approaches with Math, Research, Robotics, and Forensic Sciences: The UNE R³-STEM Project

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Abstract: The UNE R³-STEM project at Universidad del Este (UNE) currently Universidad Ana G. Méndez (UAGM), Carolina Campus, was designed to increase the recruitment, readiness, and retention of high school students in STEM career pathways. UNE's R³-STEM addresses these 3R's through two collaborative interventions: 1) High School to University Bridge Program; and 2) Faculty Curriculum Development Program. A model was designed that integrates three approaches: increase recruitment, readiness, and retention of high school students in STEM. Approaches that are curricular integration and providing both academic and non-academic support through extracurricular activities. The recruitment (R¹) consisted of recruiting faculty from different disciplines, peer-mentors, and high school students. In addition, faculty was trained in various evidence-based teaching strategies. Peer mentors also were trained in different aspects of mentoring and leadership. For readiness (R²), high school students participated in a comprehensive training that includes curricular and extracurricular aspects. Retention (R³) in this project was defined as increasing the number of high school students enrolling in STEM programs. This project provides a multi-level collaborative support system that begins in the recruiting, training phase and continues until the students' progress in STEM careers. In this process, the synergy of the academic and non-academic support is prioritized to maximize the academic performance of STEM students in an integral manner. The development of the model made possible to create a favorable environment for the active insertion.

Key-Words: student retention; interdisciplinary; robotics; forensics; STEM.

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1. Introduction

The UNE R³-STEM project at Universidad del Este (UNE), currently Ana G. Méndez University (UAGM) Carolina Campus is a collaborative effort with the objective of maximizing student development by increasing the recruitment, readiness and retention (R³) of Hispanic high school students interested in pursuing careers in Science, Technology, Engineering and Mathematics (STEM). The project addresses the critical need that exists in both Puerto Rico and the United States to increase the participation of underrepresented minorities in scientific and technological careers. UNE R³-STEM achieved its objective through two innovative collaborative interventions: 1) a High School (HS) to University Bridge Program (HS-UBP) to increase the recruitment of high-need HS students and their readiness to enter STEM academic programs; and 2) a Faculty Curriculum Development Program (FCDP) that focuses on increasing student retention by improving learning outcomes and student engagement.

The first intervention is the HS-UBP, in which underrepresented minorities high school students interested in STEM careers receive academic and non-academic support. These underrepresented minorities are economically disadvantaged and first-generation college students who are academically under-prepared, with limited English proficiency, and lack of family culture related to college attendance. The academic support consisted of a dual-enrollment program in which students can accumulate up to six college credits by completing two courses: Basic Mathematics (MAGS 101) and Introduction to Research & Information Literacy (INGS 101). Both courses integrated robotics and forensic science activities into their curriculum. In addition, the mathematics course was enriched with the learning and instructional platform EducoSoft™.

The HS-UBP was complemented by non-academic support thru mentoring and tutoring services. For the second intervention, Mathematics, Engineering, Forensic Sciences and Research faculty were trained in evidence-based teaching practices and educational research to improve teaching-learning processes for students in STEM. The multidisciplinary faculty worked together in the curricular integration of STEM activities within the impacted courses.

The curricular integration facilitated a dialogue among disciplines that resulted in an interdisciplinary team. Both interventions were embedded in a Model of Interdisciplinary Approaches with Math, Research, Robotic and Forensic (IMaR²Fo). The model and its phases are described in depth in the following sections.

2. IMaR²Fo Context

It is vital that universities offer innovative responses to the demands of a globalized world, where the accelerated development of technology and communications is observed. In addition, the integration of knowledge is necessary to find solutions to 21st century problems. According to Ander-Egg (2009), the integration of different disciplines demands new ways to understand a problem since one of the basic ecology principles' states: "everything is related to everything, nothing happens in an absolutely isolated way and nobody acts in complete independence" (p.268). For this reason, the IMaR²Fo model shows three approaches to increase the retention in the STEM community. These are curricular integration, academic and non-academic support.

2.1 Curriculum integration: Interdisciplinary Approaches

Interdisciplinarity is an intermediate level of integration in which the transfer of methods occurs from one discipline to another (Piaget, 1979 & Klein, 2008). From the perspective of the educational process, interdisciplinarity is the exchange between disciplines to approach a problem or object of study from another area of knowledge. The tendency in recent educational paradigms is to promote teamwork across disciplines while respecting the importance that each of the disciplines contributes to the educational process. In addition, as Morin (2002) stated in the Seven complex lessons in education for the future, it is crucial that we work as a team to achieve mutual understanding in all dimensions. Therefore, within the UNE R³-STEM project the interaction among the multidisciplinary faculty was prioritized to enhance the curricular integration through interdisciplinary approaches.

2.2 Academic Support: Dual-enrollment

Studies have shown that dual-enrollment programs have a positive impact in post-secondary education by addressing poor academic preparation and low graduation rates of high-school students (An, 2013). A study from the National Research Center for Career and Technical Education conducted by Mechur, Calcagno, Hughes, Wook and Bailey (2007), showed that high school students who participated in dual-enrollment programs had significantly higher cumulative college GPAs three years after high school graduation when compared to peers who did not participate in dual-enrollment programs. In addition, they earned more college credits (indicating progress toward a degree) than non-participating peers.

2.3 Non-Academic Support: Mentoring and Extracurricular Activities

To promote student success in STEM, it is critical to provide not only academic interventions but also include non-academic activities that support the integration of cognitive, social, and cultural aspects in educational environments to motivate students to achieve their career goals. A conceptual framework of effective mentoring and motivation has been successfully implemented in different student development programs (Good, Colthorpe, Zimbardi & Kafer, (2015), Nora & Crisp (2007), Keller (2010). This framework includes four mentoring domains: knowledge and academic skills, role modeling, emotional support, and career guidance; and four motivation factors: attention, relevance, confidence, and satisfaction.

To this extent, the UNE R³-STEM project is structured on Tinto's theory for student retention (1993) which is composed of three dimensions: a) *Academic*: Promotes strategies for the student's academic success; b) *Student*: Provides advice for the successful achievement of academic goals; and c) *Administrative*: Manages and tracks students to facilitate proactive decision-making. The project is also enriched with Seidman's retention formula (2005), which uses early identification strategies and timely, intensive and continuous intervention. In addition, the institutional Retention Office offered support to this project by: 1) integrating STEM Faculty as student's advisors; 2) conducting workshops and services on issues of retention and academic success; 3) establishing individual education plans and monitoring the progress of the students with the peer mentoring; 4) supporting efforts to create learning environments that promote student success. These arguments served as support for the design of the IMaR²Fo Model (Figure 1).

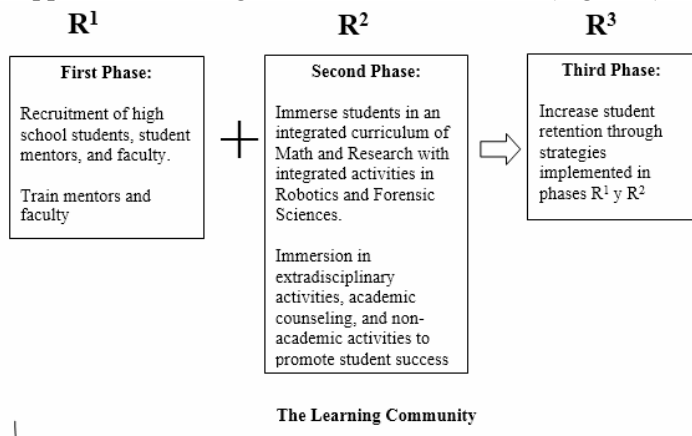


Figure 1. IMaR²Fo Model R³ Recruitment, Readiness, and Retention

2.4 Phases of the IMaR²Fo Model

R¹ Recruitment. Consisted of recruiting a multidisciplinary faculty in the areas of Mathematics, Engineering and Forensic Sciences and Research

that was trained in the integration of teaching strategies applied to STEM using a *Train the Trainer* format, as these faculty will in turn, train other faculty members. Undergraduate students enrolled in STEM programs were recruited as peer mentors and received training in effective communication, leadership, and mentoring. High school students interested in STEM careers were recruited to participate in the HS-UBP program.

R² Readiness. It is an integral formation that consisted of curricular and extracurricular aspects of high school students.

R³ Retention. Consisted of increasing the number of freshmen who selected a STEM career.

2.5 Description of the First Phase

The recruitment phase consisted of three (3) components: a) Faculty: Faculty representations were in the areas of mathematics, engineering, research, and forensic science. They were trained during a semester in teaching strategies. Professional development was facilitated once a week face-to-face workshops during an academic semester; b) High school students: Thirty (30) students interested in STEM careers were recruited and enrolled in a math course and a research course integrating robotics and forensic science activities and c) Peer Mentors: Undergraduate students were identified by the project managers and trained through 40 hours of workshops related to mentoring and mathematics applied to robotics. The process of the first phase is shown in Figure 2.

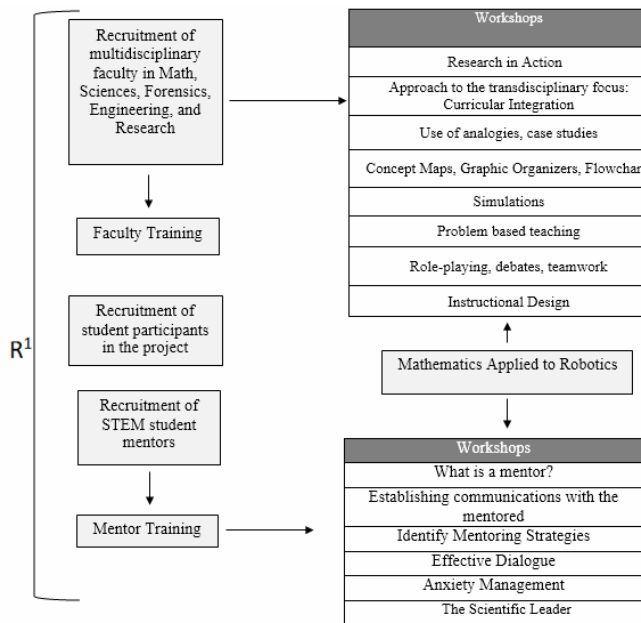


Figure 2. R¹: Recruitment and Training

2.6 Description of the Second Phase

In the readiness phase (Figure 3), an interdisciplinary team was setup among faculty from mathematics, engineering, research, and forensic sciences disciplines. This team implemented the previously developed curricular integration activities considering the common areas and skills in the contents of the courses. The high school students took a math and a research course, which were complemented with curricular integration activities in the areas of robotics and forensic sciences. The educational process integrated both the students and their peer mentors. Meanwhile the extracurricular training included academic counseling, non-academic activities, and parent support, in order to fully immerse high school students in the STEM learning community. In effect, a learning community for this project was understood as a set of academic and non-academic activities aimed at achieving the educational transformation of the STEM student in the institution in an integral way.

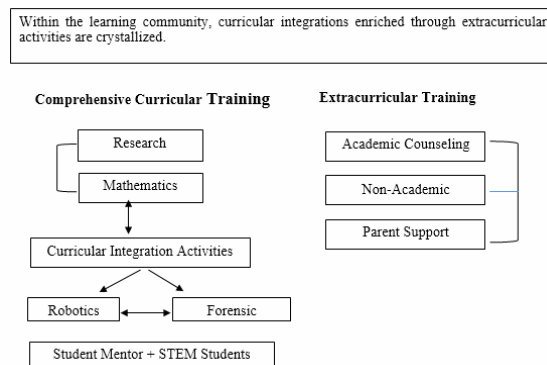


Figure 3. R²: Readiness (Training). An integral formation consists of curricular and extracurricular aspects.

2.7 Description of the Third Phase

The retention phase was the outcome of the recruitment and training phases. This phase consisted of increasing the number of students in STEM careers (Figure 4). In addition, the recruitment and training of a multidisciplinary faculty from the disciplines of Mathematics, Engineering, Forensic Sciences and Research contributed to the integration of different points of view, enrichment and relevance of STEM students' learning. The capacity-building of faculty exerted a chain reaction in which STEM students were impacted more than once by the educational strategies. Therefore, it is presumed that the "Train the Trainer" strategy, which directly and indirectly affected the learning process impacted the STEM retention phase. Another factor impacting the retention of students was the comprehensive training received through the HS-UBP program, which included curricular and extracurricular aspects. This project provided a collaborative support system

of several levels that interacted with a defined purpose of STEM retention. Observations and evaluations were added to the process to comprehensively assess students' progress in STEM careers.

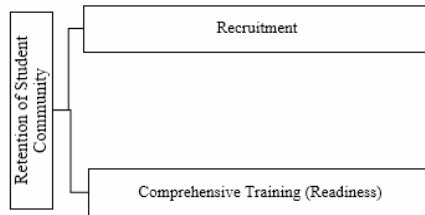


Figure 4. R³ Retention. Retention consists of increasing the number of students in STEM career.

3. Strengths of the Model

1. The IMaR²Fo Model to be implemented every year will be adjusted considering the data obtained in the preceding cycles. The adjustment will allow addressing the obstacles encountered in the process to achieve an optimal result of the project. Based on action research, possible problematic situations will be identified that will be addressed as they emerge in the development of the project. This aspect of constant reflection and formative evaluation strengthens the internal validity in the implementation of the two initial phases, recruitment and training.
2. Working in interdisciplinary teams enriches the academic contribution of each faculty who teach the dual-enrollment courses because they work within each discipline and share the same work goal (Torres, 1994). Modeling teamwork encourages other faculty to use this strategy in their classroom.
3. The contextualization of mathematics courses using real-life contexts allows learners to interact with their environment, an aspect that serves as a motivation in the teaching of this discipline. In addition, it allows learning issues to be addressed from different perspectives within the learning community.
4. *Train the Trainer* is a good strategy for the development of the faculty as it broadens the knowledge that each specialist has about teaching strategies in other areas, and it provides an exchange of knowledge in common and non-common areas to achieve optimal teaching strategies.

5. Peer-mentoring improves STEM knowledge in undergraduate students by helping their peers and in turn increases their self-confidence.
6. The extracurricular training provides a glimpse at the daily tasks related to the educational process within the learning community, which cannot be completely isolated from the academic performance of the STEM student.

In summary, as described above, UNE R³-STEM provides a multi-level collaborative support system that begins in the recruitment and training phrases and continues until students' progress in STEM careers.

4. Evaluation of the IMar2Fo Model

The model was evaluated during the first year of the project to determine its operating capacity. Results for the recruitment phase (R¹) of the model were evaluated during the first year of the project, specifically for faculty recruitment and development. The evaluation objectives were to: 1) evaluate the development of the HS-UBP, and 2) evaluate the FCDP. The results and conclusions of each objective are described below.

Objective 1. Establish a HS-UBP to increase recruitment of disadvantaged Hispanic HS students and their readiness for math and engineering.

The goal was to recruit 30 high school students from public schools in the institution's service area. The recruitment criteria to select the students were: entering in their senior year of high school, interested in STEM careers offered at the institution, and having a GPA of >2.0. During the recruitment phase, the project was presented at six high schools in our service area, impacting more than 200 students, of which 70 applied to participate in the project and 36 were admitted of which 56 % percent of the participants were female. Recruitment of faculty from education, mathematics, engineering, research, and forensic sciences included seven professors, 2 full-time and 5 part-time. However, a total of 30 professors participated in the workshops offered by the FCDP as the invitation was extended to all faculty at the institution. As such, faculty from the following disciplines participated: Social work, Psychology, Engineering, Mathematics, Microbiology, and Physics, Library sciences, English and Forensic sciences. In addition, five undergraduate students were recruited to serve as peer-mentors and tutors of the high school students. The recruitment criteria for the undergraduate students were to be enrolled in a STEM program, being in their sophomore year, having a GPA of ≥ 3.20 , being recommended by faculty, and demonstrated interest in serving as a peer mentor.

Objective 2. Establish an FCDP to increase student retention by improving learning outcomes in math and engineering.

Bransford, Brown, & Cocking (2000) indicate that a change in the traditional paradigm of instruction (i.e., focused on the teacher or faculty member) to a student-centered approach promotes experiences that actively involve students in the learning process. To this extent, faculty were trained in holistic and innovative strategies necessary to address the needs of the student population by supporting their learning process and engagement. The topics of the workshops offered were Action Research, Extra-disciplinary Approaches/Curricular Integration, Graphic Organizers/Flowcharts, Case Studies, Concept Maps, Simulations, Problem-based Learning, Role Play/Debates and Cooperative Work. The selected topics were consistent with those discussed by Marzano, Pickering, & Pollock (2001) and others (Handelsman et al, (2004); National Council of Research (2012). The workshops were offered on a weekly basis for a total of 40 contact hours. All workshops were submitted and approved for continuing education credits. To evaluate the learning outcomes of the workshops, participants completed a pre- and post-test. It is important to note that the instruments administered collected both quantitative and qualitative data. Different assessment strategies were used during the workshops, such as a focused list, timelines, dialectic notes, checklists, and traditional multiple-choice tests were applied. In this way, the participating faculty received training in both teaching and assessment strategies without the need for additional contact hours. In addition, faculty satisfaction for each workshop was evaluated. The results are described below. To analyze the data, descriptive statistics were applied using the Intellectus Statistics program (2018). In the pre-tests, the initial faculty performance varied between 62% and 85%, while in the post-tests the performance average increased between 88% and 97%. Results (Figure 5) showed that the faculty had previous knowledge of strategies linked to cooperative work, conceptual maps, simulations, flow charts and case studies. However, they had less knowledge in Role play/debates, Problem-based learning, Action Research, and extra-disciplinary approaches /curricular integration. The results reflect the necessity to reinforce training in Action Research and subjects related to the extra-disciplinary approach and curricular integration, as they are not commonly applied in teaching.

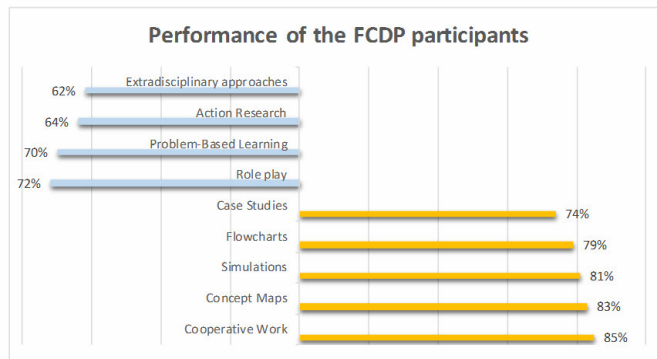


Figure 5. Performance of the FCDP participants

Overall, the application of the IMaR²Fo model allowed for the simultaneous training of faculty from different disciplinary areas. For the initial evaluation, a comparison sheet was developed (Table 1) as a working document to identify the evaluation status of each strength. The six strengths of the model are shown in the first column and its status classified using the following criteria were: a) Evaluated; b) Evaluated but requires adjustments in the next cycles; c) Not Evaluated. The strengths evaluations will be embedded in an Action Research plan to continuously assess the operationalization of the model. To this extent, the implementation of the IMaR²Fo model may change to some degree each year based on formative evaluation.

Strengths	Criteria		
	Evaluated in the first intervention.	Evaluated but requires adjustments in the subsequent cycles.	Not evaluated in the first intervention.
1. The IMaR ² Fo model to be implemented every year will be adjusted in light of the data obtained in the preceding cycles using an Action Research approach. This adjustment will allow attending obstacles encountered in the process to achieve an optimal result of the project. Constant reflection and formative evaluation strengthen the internal validity of the model in the implementation of the two initial phases, recruitment and training.		X	

<p>2. Work in interdisciplinary teams enriches the academic contribution of each teacher who teaches the courses because they work within each discipline and share the same work objective (Torres, 1994). Modeling teamwork encourages other teachers to expose themselves to this strategy.</p>	<p>X</p>
<p>3. The contextualization of the teaching of mathematics in real-life scenarios allow learners to interact with their environment, an aspect that serves as a motivation in the teaching of this discipline. In addition, it allows addressing learning issues from different perspectives within the learning community.</p>	<p>X</p>
<p>4. <i>Train the Trainer</i> is a good strategy from the point of view of the development of the faculty. In addition, it broadens the knowledge that each specialist has about teaching strategies in other areas. It is an exchange of knowledge in common and non-common areas working to achieve optimal teaching strategies.</p>	<p>X</p>
<p>5. Mentoring by undergraduate students contributes to the management of knowledge that is evident in each participant, by the greater degree of confidence and sense of reflection that the participants feel and observe in their mentor who is also a peer.</p>	<p>X</p>
<p>6. Extracurricular training allows exposure to daily tasks related to the educational process within the learning community, and that are not separate from the academic performance of the STEM student.</p>	<p>X</p>

Table 1. Strengths of the IMaR2Fo Model

The initial evaluation of the IMaR2Fo strengths showed that: 1) the conceptual basis of the first strength allows for adjustments to be worked throughout the development of the project without departing from the

essential aspects of Action Research; 2) an interdisciplinary team was achieved when the recruited professors joined the program and other faculty took the training voluntarily; 3) real-life scenarios were used to contextualize educational strategies in mathematics, research, forensic sciences, robotics and others and 4) the train the trainer strategy was partially achieved during the first year by pairing a senior educational researcher with a junior educational researcher to develop the IMaR²Fo model and training modules, and when the junior educational researcher provided the workshops to the interdisciplinary faculty.

5. Conclusions

In summary, reflecting about the educational *praxis* is crucial in the operationalization of the IMaR²Fo model. Currently in higher education, it is essential to become familiarized with different evidence-based teaching strategies that improve the development of competences such as scientific and quantitative reasoning, critical thinking, research and technology, among others. To this extent, there is a need of capacity building in educational strategies in STEM faculty. Usually this matter is treated very lightly or not treated with the required importance. This project attempts to correct this aspect by providing capacity-building opportunities to faculty from STEM disciplines and promoting faculty engagement in interdisciplinary educational *praxis*. Based on the aforementioned, faculty capacity building was an essential step to accomplish the goals of UNE R³-STEM project, which were to increase the recruitment, readiness and retention of disadvantaged Hispanic high school students interested in pursuing careers STEM.

References

- Ander-Egg, E. (2009). *El trabajo en equipo*. Madrid: Editorial Servilibro.
- Bransford, J.D., Brown, A.L., & Cocking, R.R. (2000). *How people learn: Brain, mind, experience, and school*. Washington D. C.: The National Academies Press.
- An, B. P. (2013). The impact of dual enrollment of college degree attainment: Do Low-SES students benefit? *Educational Evaluation and Policy Analysis*, 35(1) doi:10.31022F0162373712461933
- Educsoft (Online Computer Software). (2018). https://www.educosoft.com/Home/US/es_u_default.aspx
- Good, J., Colthorpe, K., Zimbardi, K., & Kafer, G. (2015). The roles of mentoring and motivation in student teaching assistant interactions and in improving experience in first-year biology laboratory classes. *Journal of College Science Teaching*, 44(4), 88-98.

- Handelsman, J., Ebert-May, D., Beichner, R., Bruns, P., Chang, A., DeHaan, R... & Wood, W. B. (2004). Education. Scientific teaching. *Science*, 304(5670), 521–522. doi: 10.1126/science.1096022
- Intellectus Statistics (Online Computer Software). (2018). <https://www.intellectusstatistics.com/>
- Keller J.M. (2010) *What is motivational design?. Motivational design for learning and performance*. Boston, MA: Springer..
- Klein J. T. (2008). Evaluation of interdisciplinary and transdisciplinary research: a literature review. *American Journal of Preventive Medicine*, 35 (2 Suppl), S116–S123. doi: 10.1016/j.amepre.2008.05.010
- Marzano, R.J., Pickering, D.J., & Pollock, J.E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: Association for Supervision and Curriculum Development. Association for Supervision and Curriculum Development.
- Mechur, K. M., Calcagno J., C., Hughes, K. L., Wook, J. D., & Bailey, T. R. (2007). *The post-secondary achievement of participant in dual enrollment: An analysis of student outcomes in two states*. National Research Center for Career and Technical Education. Retrieved from <https://files.eric.ed.gov/fulltext/ED498661.pdf>
- Morin, E. (2002). *Los siete saberes necesarios para la educación del futuro*. Madrid: Ediciones Nueva Visión.
- National Research Council (2012). *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. Washington D. C.: The National Academies Press..
- Nora, A., & Crisp, G. (2007). Mentoring students: Conceptualizing and validating the multi-dimensions of a support system. *Journal of College Student Retention: Research, Theory & Practice*, 9(3), 337–356. doi: 10.2190/CS.9.3.e
- Piaget, J. (1979). For an epistemology of interdisciplinary relations. In L. Apostel, & G. Seidman, A. (ed.). *College student retention: Formula for student success* (pp. 34-51). Westport, CT: Praeger Publishers.
- Tinto V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed). Chicago, IL: University of Chicago Press.
- Torres, J. (1994). *Globalización e interdisciplinariedad: Currículo integrado*. Barcelona: Ediciones Morata, S.L.
- Universidad del Este (2015). “*UNE R3-STEM: an institutional program to increase recruitment, readiness and retention of high-need High School students in STEM career pathways*” *Minority Science & Engineering Improvement Program Institutional Project 2015-2018*. Universidad del Este, SUAGM.



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