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Methods for developing an analytical framework to study the inclusion of information and research skills in higher education curricula

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Abstract: This article sets and describes the six stages of an ongoing research that aims at generating an analytical framework to conduct a worldwide study on how bachelor-level higher education curricula aids in teaching and developing information and research skills. We describe the problem statement behind our research proposal, its research questions and the planned research stages.
Keywords: information literacy, research skills, curriculum, higher education, bachelor programs.

1. Introduction

University activities are based on the development of three main axes, which ensure their correct operation as educational institutions: teaching, research, and extension. It is fundamental for universities to fulfill their activities within these three axes, so they can position and rank within their own countries and internationally. However, the research axis has arguably weakened in Mexico, because many universities have exclusively worked within the boundaries of the teaching and extension. Some universities have exclusively centered on teaching, neglecting research completely. We can mention several possible reasons behind this, among others the lack of budget or interest for conducting research and because those universities not producing research may not have the appropriate staff to reverse this tendency. Moreover, there are several issues: a) a general collapse of reading habits; b) challenges related to information literacy (IL) and digital literacy; c) incorrect practices while teaching methodology courses; and d) the widespread emergence of educational programs (undergraduate and even graduate) that do not require a thesis as a terminal

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requirement for graduation. These issues allow highlighting the emerging importance of the collaborations among librarians and educators.

1.1. Research within higher education

Research contents and skills must be taught from the moment that students start their university life. This will help them determine if they wish to continue pursuing an academic and research career or if they prefer to dedicate to the professional practice of their field. Teaching about research is possible through the development and implementation of courses dedicated to such activity (e.g. research methods, research or thesis seminars). In these courses, students are taught: a) how to conduct research; b) employ the scientific method; c) use information resources and harness their curiosity for discovering new things; and d) how to develop their scientific and information competences. The latter involves using, selecting and analyzing information in order to create high-quality and scientific contents. One of the main assumptions behind this research is that professors who conduct research and publish their results might be better at teaching the university courses related to research, than those professors without research activities. Moreover, "the quality of teaching is positively associated to the elaboration of books or multimedia teaching materials" (García-Gallego et al., 2015: 20).

Research universities are substantially different to teaching universities, as each university provides knowledge of different nature (Fram & Lau, 1996). Research is important on those universities where many methodological and practical activities are developed, but they leave behind epistemological work. Thus, "they do not recognize the enlightened practice of research, which is not acquired by copying, pasting, memorizing, but by conducting it with patience, will, dedication, perseverance and discipline, because it consists on a kind of know-how" (Zeña, 2015: 123).

Within the Mexican context, Tarango and Machin-Mastromatteo (2016) comment that professors are hired to teach, not necessarily for conducting research. These authors claim that Mexico needs to strengthen professors' research competences and they must face various challenges, such as working under the current conditions and identifying opportunities for growth, while universities need to set research priorities.

1.2. Research and curriculum

Given the implications discussed above, it is necessary to implement university curricula that would foster research activities in students and contribute to their training as new researchers, centering on high-quality teaching and learning. Evaluating the quality of research activities is particularly important for understanding the level of development of a given country (Moed, 2005; Allik, 2008). Hence, training students on research is required for helping society to

study and understand their own context and for aiding alumni to be capable of improving their quality of life and engage in the development of their countries. Arguably, the practice of research and critical thinking would help citizens face the problems of everyday life.

Curriculum theory is defined as "the interdisciplinary study of educational experience" (Pinar, 2004: 2). Hence, curriculum can be studied from diverse sciences and so disciplines interact within its study, giving way to curricular constructions and ensuring that each educational program centers on solving society's problems. Pinar (2004) also comments that "curriculum theory is, then, about discovering and articulating, for oneself and with others, the educational significance of the school subjects for self and society in the ever-changing historical moment" (p. 16). The curriculum needs to be continuously updated, according to the historical and political reforms, and considering the contextual needs of the population in general. Such expressions are grounded on Tyler (1949), who states that contemporary life is in constant change and we need to focus education on today's critical aspects, going beyond the issues that were important or have already been resolved.

1.3. Problem statement and research questions

It is complex to implement research courses within universities while avoiding the perception that they are 'filler' courses; a perception that some students, professors, and the university administration may have. Unlike typical disciplinary courses from each program, research methods courses may be seen with a certain indifference and they may be taught by professors who are not researchers. These issues might prevent an effective knowledge transmission and result in students perceiving the course as 'boring'. Other challenges related to students include: a) engaging students with research; b) ensuring that they will acquire the necessary tools for conducting research; c) provide them with opportunities for enhancing their abilities to analyze, criticize and synthesize; d) improve their IL and scientific reasoning; and e) tapping into the full potential of the digital resources and technologies acquired by the university. The abilities related to such challenges must be developed into competences that the individual will require during their whole professional and personal lives. Therefore the university is required to train individuals competent in research, as they most likely will also become critical citizens.

This research project seeks to respond to the mentioned certain challenges in Mexican universities, particularly those associated with: a) training new researchers; b) enhancing research within higher education institutions; and c) aid universities in sustaining and increasing their research competitiveness. The latter is important for any university wishing to be present in international institutional rankings and being successful in any bibliometric analysis. Among the reasons behind the weaknesses related to research, we can count: a) issues with the quality of the information and digital skills developed in universities; b)

the level of competence that both students and professors achieve in such skills; and c) IL in general.

Considering the cited issues, we propose to conduct a curricular study on various universities, by surveying several undergraduate programs at an international level, to analyze the presence and qualities of different elements in their curriculum. Such analysis will lead to the development of a common curricular framework (CCF) that may be transversally implemented (or as individual courses) in the curriculum of other universities. Although the following is not an exhaustive list, we propose to study curricular aspects such as: a) infrastructure; b) resources; c) competences; d) course contents; e) technologies; f) teaching and learning methods; and g) educational strategies and techniques. From the problem statement of this research, we derived the following research questions:

a) What are the characteristics of the scientific indicators from the universities that are positioned in international rankings?
b) How are such rankings related to scientific production and research training?
c) What are the characteristics, strategies and best practices that can integrate a CCF for developing research skills?
d) Which educational strategies, contents and resources are the most successful for developing research skills?

This research is important because we will conduct an international and comparative study of the universities that have been successful in providing research training. Such analysis will also result in the development of the CCF with a series of guidelines that can be implemented in other universities to improve research and information training. If future curricula consider our CCF and its guidelines, they may favor alumni wishing to continue a career in teaching and research. This would also benefit individuals pursuing graduate studies and even those making the decision of just practicing their profession. Such line of research can also benefit society in general, because offering better training on information and research would arguably contribute to the development of more informed and scientifically aware citizens.

Additionally, the institution where this research is being conducted, Universidad Autónoma de Chihuahua (UACH) in Mexico, is currently working on a New Educational Model (NEM). Such endeavor has implied reformulating every curricular aspect for the university. Hence, this research brings forth an opportunity of suggesting and implementing the CCF in the different programs and at the different educational levels at UACH. This would help strengthening information and research at the university.

2. Methodology

This research has been planned to follow an explanatory sequential mixed methods design, as we will collect both quantitative and qualitative data samples, which will be analyzed according to their nature (Creswell & Creswell, 2018). The quantitative data to be collected corresponds to the development of a bibliometric study with data from the rankings produced by Scimago (Scimago Lab, 2020a, 2020b). Quantitative data will serve sampling purposes (see stage 2 below) and will aid in answering research questions 'a' and 'b'. Qualitative data will be directly collected from the bachelor-level study programs from selected universities (i.e. data will be directly collected from the documents with the study programs), which will correspond to courses related to research and information. Qualitative data will be employed for answering research questions 'c' and 'd'. These programs will be either collected from the universities' websites or directly requested. From the characteristics of this research, which we are just starting, we have formulated six research stages, which are explained below.

2.1. Stage 1. Define the categories for analyzing curricula

In order to start a curricular study, it is important to define the elements that will be studied in the study programs. Table 1 below presents the categories of analysis that will be used to review the study programs from the selected universities and for developing the CCF. During the analysis of the first cases (i.e. the first study programs analyzed), these categories may be enriched with new ones, or they can even be re-defined as this first set of cases are analyzed; either way, this process will be documented. The above considerations will aid in obtaining the best possible results.

Table 1. Categories of analysis for reviewing the study programs

Category	Definition
Infrastructure	Includes the structural aspects, the electrical, hydraulic, sanitary, gas and air conditioning facilities, as well as the equipment, application of sustainable systems and technologies, the furniture and diverse equipment that are required from educational activities (Gobierno de México, 2013; Miranda, 2018). These criteria would also include organizational and administrative structures.
Resources	They conform the pedagogical support elements that reinforce professors' actions, optimizing teaching and learning processes (Vargas, 2017).
Competences	They imply a kind of knowledge beyond modernity's traditional knowledge, it constitutes the know-how (Aguerrondo, 2009). They encompass complex performance processes that are ideal in determined contexts, integrating different kinds of knowledge (learning to be, know-how and learning to live together), for conducting activities and

	problem-solving with a sense of challenge, motivation, flexibility, creativity, understanding, and entrepreneurship (Tobón, 2007).
Course contents	Resources that are used in learning events (Sicilia, 2007).
Technologies	Any software or hardware element that is modified to fulfill a learning endeavor or directly developed for working under such purpose.
Teaching and learning methods	Structural procedures (analyzable and open to criticism) that are empirically contrastable (with their results and with other methods) and theoretically justifiable (explainable) (Bunge, 1968); aimed at aiding teaching and learning.
Educational strategies and techniques	Techniques employed to manage teaching and learning processes effectively and systematically (De la Torre, 2005, cited by Delgado & Solano, 2009). They aid in planning, organizing, developing and evaluating teaching and learning situations, environments or scenarios (Campos, 2012).

2.2. Stage 2. Data analysis from rankings

Scimago's rakings were selected as the most pertinent for using in this research, because: a) Scimago Institutions Rankings (Scimago Lab, 2020a) is the international ranking of institutions that grants the highest importance to research indicators in their evaluation; b) their rankings employ data from Scopus and other pertinent databases for evaluating all of the indicators set by Scimago; c) Scimago Journal & Country Rank (Scimago Lab, 2020b) allow assessing each countries' number of relevant institutions and general scientific production indicators; and d) Scimago's reports and data are easily accessible and downloadable at no cost. Hence, the process for selecting the sample of universities that will be studied will start from the statistical analysis of data from Scimago's rankings (Scimago Lab, 2020a, 2020b), for which we will employ a statistical analysis software.

Scimago Institutions Rankings evaluates and ranks institutions at a worldwide level by concentrating, analyzing and evaluating data on the following factors: a) research performance, which includes bibliometric indicators gathered from Scopus (this factor represents 50% of the evaluation score for every institution); b) innovation results, which uses data from the PATSTAT database (30% of the evaluation score); and c) social impact and web performance (20% of the evaluation score). The last aspect considers Altmetrics, by using the PlumX database and data from the Mendeley reference manager; moreover, it evaluates institutional websites' performance through data from Google and Ahrefs, e.g. for determining the number of links toward a given institutional website and its size (Scimago Lab, 2020a). Scimago groups institutions in five types: higher education, government, health, private and others. Ranked institutions must have at least 100 documents indexed in Scopus during the year under

evaluation. In 2020, Scimago evaluated and ranked 7,026 institutions worldwide. For the purposes of this study, we will gather the complete dataset from Scimago to identify the most relevant and successful institutions regarding research. This will be the first criteria for selecting the sample of 100 universities to be evaluated in this study.

2.3. Stage 3. Verification of universities' accessibility

Although Scimago Institutions Rankings easily allows identifying a sample of the most successful universities in research, we also need to confirm which universities allow access to their study programs, specifically from courses related to information and research, either by providing them in their websites or if they provide them after a formal request. Moreover, we will select those universities that have their study programs in the languages that this group of researchers are proficient in: Spanish, English and Portuguese. We have called these availability and language considerations as "study programs' access conditions".

Once we sort the data gathered from Scimago in stage 2, we will start, from the top of the list (i.e. the highest ranked university will be the first one on the list), to investigate which universities meet the study programs' access conditions. Furthermore, we will use a stratified sampling that, although limited to a total number of 100 universities, would allow for a proportional representation of countries according to three criteria: a) their population sizes; b) their number of institutions ranked; and c) include institutions from all the countries where the official language is either Spanish, English or Portuguese (with the exception of other universities having their study programs in any of the cited languages). In summary, the sampling of the universities that will be studied will depend on three conditions: a) their standing on the Scimago Institutions Rankings; b) their study programs' access conditions; and c) a proportional stratified sampling.

2.4. Stage 4. Description and analysis of the scientific production indicators from the 100 universities selected

After the final sample is determined, we will use indicators from Scopus and Scimago to describe and confirm the scientific production of each university. Such analysis will center on the following indicators: a) number of articles, book chapters, books and conference proceedings published by universities' authors; b) number of authors; c) number of citations; d) h-index; e) patents; and f) altmetrics. This quantitative analysis will be based on the cited indicators and will be aided by using a statistical analysis software for producing descriptive and inferential statistical analyses.

2.5. Stage 5. Analysis of the study programs

After we compile the study programs centered on information and research, we will use the categories defined at Stage 1. Certainly, we need to assess their usefulness for analyzing the collected programs, because they might be further adjusted and refined (e.g. if there are some programs that exhibit any other additional characteristics that were not initially covered in our list of categories, they can be added). These qualitative data will be directly collected from the available documents with the study programs, using the mentioned categories as a framework for collecting, organizing and analyzing data; initially through open coding and considering the emergence of subcategories from the data. This will result in a qualitative analysis of the programs from the 100 universities selected.

2.6. Stage 6. Development of the common curricular framework

After the qualitative analysis of the programs is completed, such analysis will be synthesized as the CCF that may aid in developing courses centered on research and information skills. Additionally, it will contain a series of guidelines for developing related curricula, which will emerge from the international and comparative analysis of study programs. A future stage would consider the implementation at UACH of a newly designed course using the CCF. All these research stages would aid in answering the research questions and determining the usefulness of the CCF to enhance research skills and contribute to students' curiosity for research.

3. Conclusion

This research, which is still at a propositional phase, is needed in developing countries, as we require to enhance their scientific production indicators. Moreover, improving research skills can benefit both researchers and citizens, and it can generally improve scientific reasoning, information retrieval, organization and analysis. Nowadays, these are important competences, as we are seeing under the context of the COVID-19 pandemic, which evidences that the lack of these competences may cause the spread of fake news and misinformation. Therefore universities must prioritize the competences related to information and research, so that their students can start developing them from the first semesters and hence become better citizens.

Developing information and research competences support the positioning and use of libraries and information resources within universities. It may also renew the importance of information professionals who must be seen as academic partners at educational institutions; mainly because of their competences and know-how. Librarians must be in contact with professors to develop, plan, implement and evaluate IL programs, e.g. by collaborating in curriculum design and integrating IL in study programs (Chen & Lin, 2011; Iannuzzi, 2000; Wang, 2011).

Collaborations between information professionals and faculty, such as the present research, where this group of researchers is integrated by educators and information professionals, may pave the way for developing blended librarians. Such professionals' work integrates their disciplinary competences with those related to education and to information and communication technologies (Corrall, 2010). Training librarians on curricular design may also produce good results for all educational stakeholders, because librarians can make worthwhile contributions to education. Moreover, allowing librarians to collaborate on these matters contributes to the recent tendencies that bring forth the transversal and transdisciplinary value of academic work, a dynamic present in UACH's NEM.

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