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Journal of Critical Pedagogy

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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines of psychology of the education of the sociology, conditions of the educational act from the physiology, conditions of the educational act from the sciences of the communication, pedagogical techniques and the science of the methods, the sciences of the evaluation, the didactics and the theory of the programs.

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The works must be unpublished and refer to topics of psychology of the education of the sociology, conditions of the educational act from the physiology, conditions of the educational act from the sciences of the communication, pedagogical techniques and the science of the methods, the sciences of the evaluation, the didactics and the theory of the programsand other topics related to Social Sciences.

Content Presentation

In the first article we present, T*he Coursera for Campus program and its impact on UAC academic programs* by MEX-ALVAREZ, Diana Concepción, HERNÁNDEZ-CRUZ Luz María, LLANES-CHIQUINI Charlotte Monserrat and PÉREZ-CANUL, Carlos Alberto, with adscription at the Universidad Autónoma de Campeche, as a second article we present, *Leadership development in initial teacher training*, by MARTÍNEZ-MENA, María. M., RIVERA-GUTIÉRREZ, Erika and HIGUERA-ZIMBRÓN, Alejandro, with adscription at the Nova Southeastern University and Universidad Autónoma del Estado de México, as third article we present, *History Teacher's Specialized Knowledge (HTSK)* by HERNÁNDEZ-GUTIÉRREZ, Francisco Javier, MONREAL-REYES, José Luis, OCHOA-VIZCAYA, Brenda Berenice and LIZARDE-FLORES, Eugenio, with adscription at the Escuela Normal Rural "Gral. Matías Ramos Santos", as the last article we present, *Gamification as a strategy for learning concepts meaningfully* by FLORES-GONZÁLEZ, Efigenia & FLORES-GONZÁLEZ, Norma, with adscription at the Benemérita Universidad Autónoma de Puebla.

Content

Article **Journal of Critical Pedagogy**
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The Coursera for Campus program and its impact on UAC academic programs

El programa Coursera for Campus y su impacto en los programas académicos de la UAC

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Abstract

The Universidad Autónoma de Campeche (UAC), in response to the sanitary measures due to the COVID-19 confinement and in order to reinforce its educational programs through online courses, joined the "Coursera for Campus" (CfC) program. This research presents the results of a comparative analysis between the educational offer offered by CfC and its relationship with the educational programs of the UAC. The results of the educational programs are presented classified by Department of Higher Education. The area with the greatest impact is Business, with 42 courses related to 12 educational programs, and Health with 37 courses that impact 7 educational programs. CfC's Language Learning area impacts all educational programs, since all of them consider the learning of a second language. It is also worth mentioning the courses in the Social Sciences area, which benefited 24 educational programs, as they are related to some of their Learning Units.

Continuous training, Educational demands, University Virtual communities, Virtual Learning

Resumen

La Universidad Autónoma de Campeche (UAC), ante las medidas sanitarias por el confinamiento por COVID-19 y para reforzar sus programas educativos a través de los cursos en línea se incorporó al programa “Coursera for Campus” (CfC). Esta investigación presenta los resultados de un análisis comparativo entre la oferta educativa ofrecida por CfC y su impacto en los programas educativos de la UAC. Los resultados de los programas educativos se presentan clasificados por Departamento de Educación Superior. El área con mayor número impacto es la de negocios, con 42 cursos relacionados con 12 programas educativos y el área de la Salud con 37 cursos que impactan a 7 programas educativos. El área de Aprendizaje de Idiomas de CfC, impacta a todos los programas educativos, ya que todos consideran el aprendizaje de un segundo idioma. También hay que resaltar los cursos del área de Ciencias Sociales que beneficiaron a 24 programas educativos, al relacionarse con alguna de sus Unidades de Aprendizaje.

Aprendizaje virtual, Comunidades virtuales, Demandas educativas, Formación continua, Universidad

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† Researcher contributing as first author.

Introduction

Emerging technologies are digital resources, innovations and tools that in the educational context aim to improve teaching-learning processes [Sosa, 2017]. Some of these technologies used by educational institutions are virtual reality, massive open online courses (MOOCs), etc. whose purpose is to consolidate learning. [Veletsianos, 2010].

Massive open online courses or better known as MOOCs (Massive Open Online Courses), offer learning that is characterised by its non-linear and asynchronous nature, i.e., it is possible for students to learn at their own pace, due to the ease of not having a physical space, such as a classroom, in which the teacher delivers content at a certain time to students who are physically in the same place [Martin, 2018].

MOOCs are born from the first experiences of sharing online content from face-to-face courses. The limitations of interaction with "students" from other parts of the world generate this proposal that allows the generation of an audience that goes beyond acquiring the content, incorporating a learning process in which a teacher (usually a team) and a group of peers participate [Valdebenito, 2013].

Massive online courses have revolutionised the way higher education is approached worldwide, mainly in certain subjects of interest and for more developed countries [Pérez, 2016].

MOOCs are clearly defined by their open nature, by locating the information and the relationship between the different educational actors on the internet and by the fact that the size of the educational community involved in a course of these characteristics can easily exceed thousands of people (massive) [Cortés, 2018].

Therefore, MOOCs have attracted worldwide interest due to their great potential to offer free, quality and accessible training to anyone regardless of their country of origin, their previous education and without the need to pay for their enrolment (Liyanagunawardena *et al*., 2013).

Fernández Ferrer, mentions that MOOCs offer advantages for participants, both in terms of the opportunity to enrol, as well as the benefits of completing them, because they have high-level information and allow access to knowledge that most teachers do not have, opening up the possibility of a relationship between universities and schools, in conjunction with teaching and research. [Fernández, 2019] On the other hand, one of the criticisms of these tools that is considered a disadvantage is the information accumulated on the platform, accompanied by a marked lack of digital training on the part of teachers, as well as difficulties in evaluation on the part of teachers. Another disadvantage is that many of these courses require prerequisites before enrolling in a course, and low participation results in courses not being completed. There are many organisations that currently offer MOOCs, so there is a wide variety of platforms that support this type of project, such as Coursera, EdX and Udacity. A study conducted in China mentions that Harbin Medical University (HMU) delivered 741 courses using Tencent and Alibaba's platforms. Among the results obtained, the following stand out: a) 67.2% of teachers and 64.6% of students agree that face-to-face courses are the best option; b) teachers expressed problems during MOOC delivery such as "lack of training" (33.4%), "lack of interaction" (44.2%) and "lack of efficient real-time evaluation" (56.4%); c) in general, both were satisfied with the use and performance of massive courses [Zhao, 2020]. Thus, the use of MOOCs was very useful to reach more users, improve and deepen their knowledge.

However, a study conducted by Román in the state of Oaxaca mentions that there was a digital divide in terms of online education and the use of MOOCs, among the most recurrent obstacles for students were: communication (25.71%), Internet access (21.43%) and poor organisation (14. 29%). 29%) Poor communication refers to the fact that the university student is used to the whole communicative process, and feels virtual education very limiting; on the other hand, it seems that Internet connectivity is poor throughout the state, thus creating a gap and disparity in learning opportunities. The latter situation underlines that the university student does not have the necessary tools to easily adapt to changes, especially if they break with his or her routine [Román, 2020].

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Due to generalisation, completion statistics are low and raise concerns about the effectiveness of courses in achieving the desired effect on the learner when they do not take an active role in their own learning processes [Leal, 2021]. The above described, generates a remarkable attention to the evolution of MOOCs that is manifested in the publications and results obtained on the topic already mentioned above [Suárez, 2013].

On the other hand, Hernández-Ramírez used the 10 Higher Education Institutions ranked as the best Universities in Mexico based on the analysis reported by the IREG observatory, which showed a variable degree of appropriation for the use of ICTs as part of the innovation and strengthening of their educational programmes. [Hernández, 2020]. In this study it can be seen that the National Autonomous University of Mexico (UNAM) tops the list organised according to its position of importance at a national level and its position of importance at a global level according to the IREG Observatory [UniRank, 2020] and this university reports that it makes use of MOOCs for its virtual education. Faced with the pandemic situation in 2020, in order to support remote learning for students and continuous training for employees, UAC made use of MOOCs and joined the "Coursera for Campus" programme to offer all members of the university community certificates issued by prestigious universities and leading companies in different areas of knowledge for free [UAC, 2020].

Coursera is an educational platform, established in 2011, associated with prestigious universities and organisations around the world [Suárez, 2013]. Coursera based learning on four key ideas: the effectiveness of online learning, learning for mastery, peer assessment and blended learning [Martinez, 2018].

As Jeff Maggioncalda, CEO of Coursera, mentioned, "The pandemic has been a catalyst for universities to make online learning the core of their students' experience", which is why the Coursera for Campus programme was expanded to bring more universities on board. According to Leah Belsky, Coursera's chief commercial officer, "Institutions are acting boldly to support their students and workers through an unprecedented unemployment crisis.

Students need work-ready learning, employees need effective skills to work remotely, and displaced workers need to regain employment. This crisis has made it clear that we need institutions that enable access to education at all stages of civic life [Razo, 2020]. This paper focuses on the results of a comparative analysis between the educational offer offered by Coursera for Campus and its relationship with the educational programmes of the UAC. The results of the educational programmes are presented classified by Department of Higher Education. The Universidad Autónoma de Campeche is divided into Departments of Higher Education (DES), as shown in Figure 1.

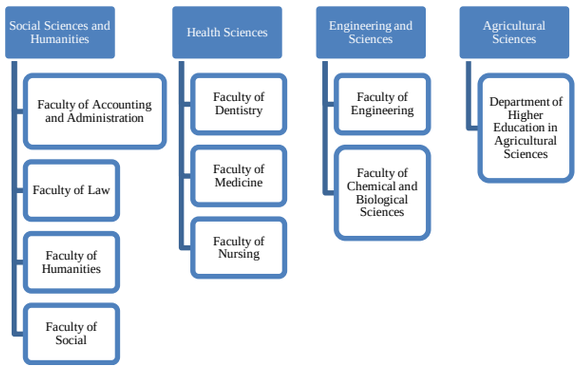

Figure 1 DES of the Universidad Autónoma de Campeche
Source: Own Elaboration

In each study plan of the educational programmes, the aim is for the student to acquire knowledge of a certain type or category and as a whole to achieve a professional profile committed to society to offer solutions to the economic, productive, social and service requirements of the state and the region.

Methodology

Taking into account the types of research studies, the present work is classified as follows:

a) According to the depth of the planned search for the knowledge to be obtained, it is of a typical descriptive type, due to the fact that it exposes the characteristics of a single sample.
b) According to the intervention of the researcher on the phenomenon studied, it is of the observational type, its main objective being to "observe and record" those events of interest for the study, without altering or intervening in their natural course.

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c) Regarding the source of data collection, it is field data, because it was collected in the place where the phenomenon occurred, which is the administrative platform of Coursera.

d) The purpose of the research is basic, as it is oriented towards the accumulation of information or the formulation of a theory, directing research on remote education with the help of the Coursera platform.

e) The data collection is cross-sectional, because it is collected in a single moment, in a single time [Rodríguez, 2007].

Variables

Coursera platform courses taught in the period May-December 2020.

Educational programmes of the Universidad Autónoma de Campeche.

Procedure for the extraction of information

Figure 2 shows the procedure developed for the extraction of information. The statistical processing of the data was carried out using Microsoft Excel, with the help of tools for descriptive studies.

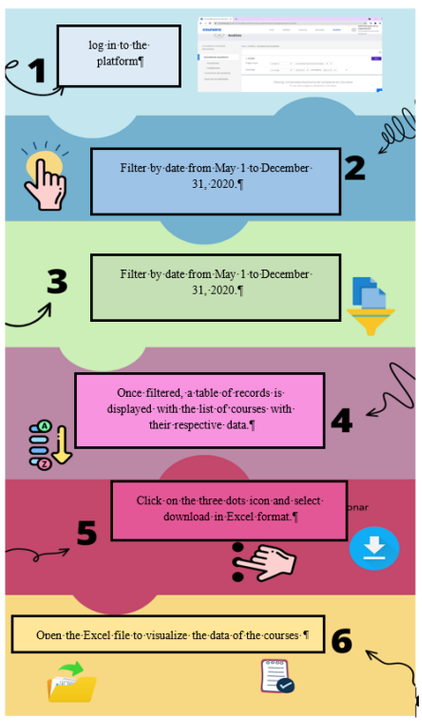

Figure 2 Procedure on the extraction of information
Source: Own Elaboration

Results and Discussion

Number of people by area

Of the total number of participants in the Coursera for Campus programme, 36% of the total number of people enrolled in the Business courses completed the courses. As for the Health courses, 255 people enrolled in this area of greatest interest to the university community and 69 people completed these courses, i.e. 27% of the total number of people enrolled. Table 1 shows the list of people registered, active and who completed the courses in the different areas of knowledge.

Area of knowledge	Inscribed	Assets	Completed
Arts and Humanities	67	48	4
Business	192	152	70
Computing	1	0	0
Computer Science	74	54	19
Data Science	51	37	8
Health	255	187	69
Information Technology	20	17	5
Language Learning	100	84	25
Mathematics and Logic	12	10	1
Personal Development	54	44	25
Physical Science and Engineering	71	53	21
Social Science	113	95	38

Table 1 Activity of persons by area of knowledge
Source: Own Elaboration

Number of courses by area

Of the 404 courses taught on the Coursera for Campus platform for the university community of the Universidad Autónoma de Campeche, 338 were active during the period May-December 2020 and 166 were completed. Table 2 shows the number of courses taught, active and completed by knowledge area.

Area of knowledge	inscribed	Assets	completed
Arts and Humanities	35	27	4
Business	72	62	40
Computing	1	0	0
Computer Science	39	30	13
Data Science	27	20	5
Health	89	74	37
Information Technology	7	6	2
Language Learning	33	30	18
Mathematics and Logic	5	5	1
Personal Development	16	16	1
Physical Science and Engineering	41	32	15
Social Science	39	36	21

Table 2 Number of courses delivered, active and completed
Source: Own Elaboration

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Department of Higher Education in Engineering and Science

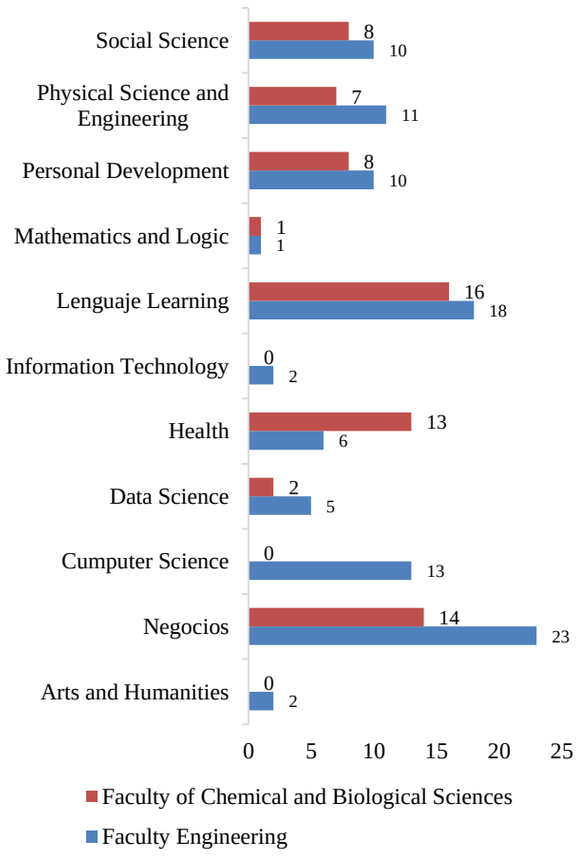
For engineering, knowledge from Basic Sciences and Mathematics, Social Sciences and Humanities, Engineering Sciences, Languages, Applied Engineering and Engineering Design, Economic-Administrative Sciences and other courses are used. Therefore, the Coursera courses within the areas mentioned by the curricula are useful to complement their knowledge, such is the case of the courses within the Business area, most of them complement the knowledge for administration, since in the graduate profiles for each engineering, the aim is for each professional to have leadership and an entrepreneurial culture.

The same is true for the area of computer science and data science, where these courses are essential to strengthen their knowledge in the fields of programming and business. Another area is personal development, in which the Digital Competences courses stand out because they make use of tools such as Excel, Microsoft and Power Point, as well as the Being more creative course because an engineer is a dreamer, innovator, researcher and creative person who solves a problem.

On the other hand, we have the undergraduate courses of the Faculty of Chemical and Biological Sciences that use knowledge in Basic and Physical Sciences, Biomedical Sciences, Pharmaceutical Sciences, Social Sciences and Humanities, Analytical Disciplines, Chemical Sciences, Social Transcendence, Management and Conservation of Natural Resources and Languages, each one of the mentioned areas allows the achievement of health education, environmental education, respect for human rights, cooperation, coexistence and respect for one and the others.

So Coursera courses were helpful in supplementing their knowledge in the areas of mathematics and logic, physical sciences and engineering, social sciences and languages. For example, the courses An approach to carbon chemistry and Chemistry in my house? complemented the profile of the students of these degrees, as it is more focused on their curricula.

Graph 1 shows the list of completed courses that benefited the curricula of each faculty. As can be seen, of the total number of courses completed in each area of knowledge, only some benefited the curricula, as in the case of Business, 40 courses were completed and 14 benefited the study plan of the chemists-biologists, while 23 benefited those of engineering, due to the fact that the profile of the engineer covers the areas of administration. The opposite is the case in the area of health, where, of the 37 courses completed, 13 benefited the professional profile of the chemist-biologist and only 6 benefited the engineering students.



Graph 1 Number of courses according to area of knowledge by Faculty of the DES of Engineering and Sciences on which they have an impact
Source: Own Elaboration

Department of Higher Education in the Social Sciences and Humanities

For the bachelor's degrees of the Faculty of Social Sciences, knowledge in Basic Sciences, Social Sciences, Economic-Administrative Sciences and languages are used.

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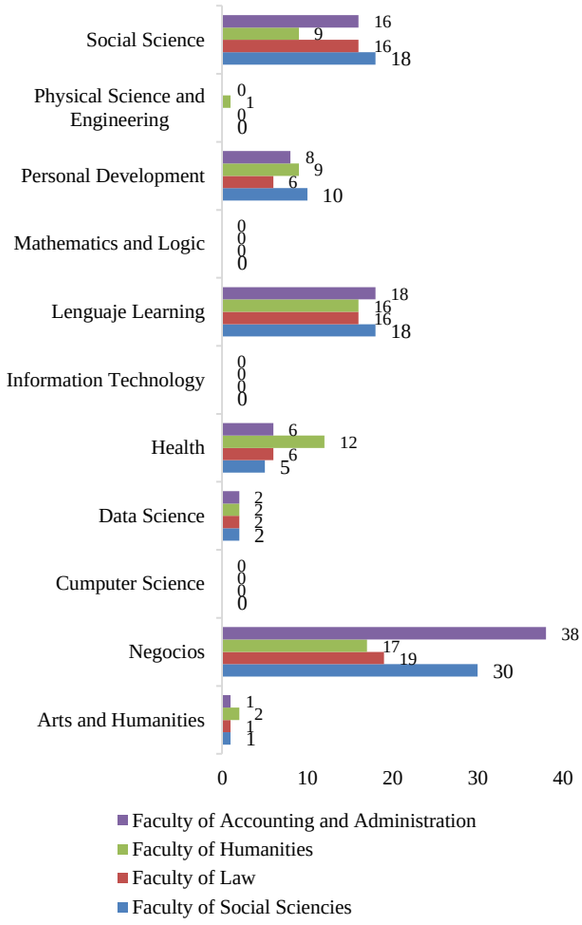
Also for the bachelor's degrees of the Faculty of Accounting and Administration, knowledge in Economic-Administrative Sciences, Research Methodology, Social Sciences, Basic Sciences and Mathematics is used and in an extracurricular form the student must accredit competences in Microsoft: Word, Excel and Power Point. In order to develop their analytical, methodological, numerical, normative and social skills that will enable them to enter the productive sphere in a committed professional manner.

On the other hand, the bachelor's degrees of the Faculty of Humanities use knowledge in the area of Arts and Humanities, Culture, Social Sciences, Business, Health, History, Personal Development and Languages. While the Faculty of Law bachelor's degrees use knowledge in Social Sciences, Philosophy, Methodology, Personal Development, Business and Languages.

Figure 2 shows the ratio of completed courses that benefited the curricula of each Faculty. It can be seen that the area of Business benefited the Faculty of Accounting and Administration with 38 courses in its study plan, as well as the Faculty of Social Sciences with 30 courses, the Faculty of Law with 19 and the Faculty of Humanities with 19, as its study plan includes a workshop for entrepreneurs where accounting concepts are covered. While the areas of Health did not have a great benefit in terms of the study plan of the degrees of this department.



Graph 2 Number of courses according to area of knowledge by Faculty of the DES of Social Sciences and Humanities on which they have an impact
Source: Own Elaboration

Department of Higher Education in Health Sciences

Figure 3 shows that the courses in the Health area benefited the Faculty of Medicine and Nursing with a total of 33 courses out of the 37 courses completed. The Faculty of Dentistry was positively impacted with 6 courses dealing with topics related to its curriculum. Other areas that benefited the Health Sciences department included Social Sciences, Personal Development, Business and Languages. In business, they benefited from the way in which all the UAC degrees have a subject in their study plan entitled Entrepreneurship Workshop, in which basic accounting topics are covered in order to start a business, since the aim as professionals is for everyone to be entrepreneurs.

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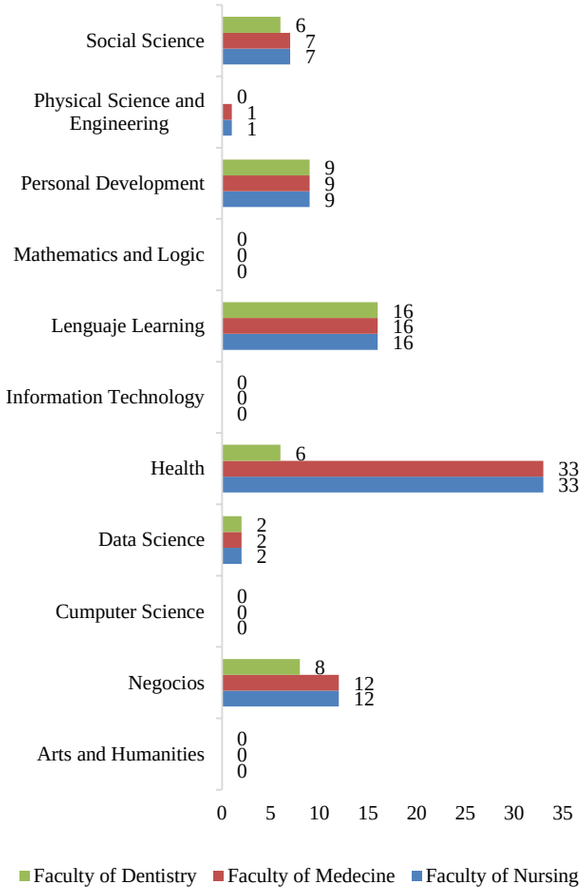
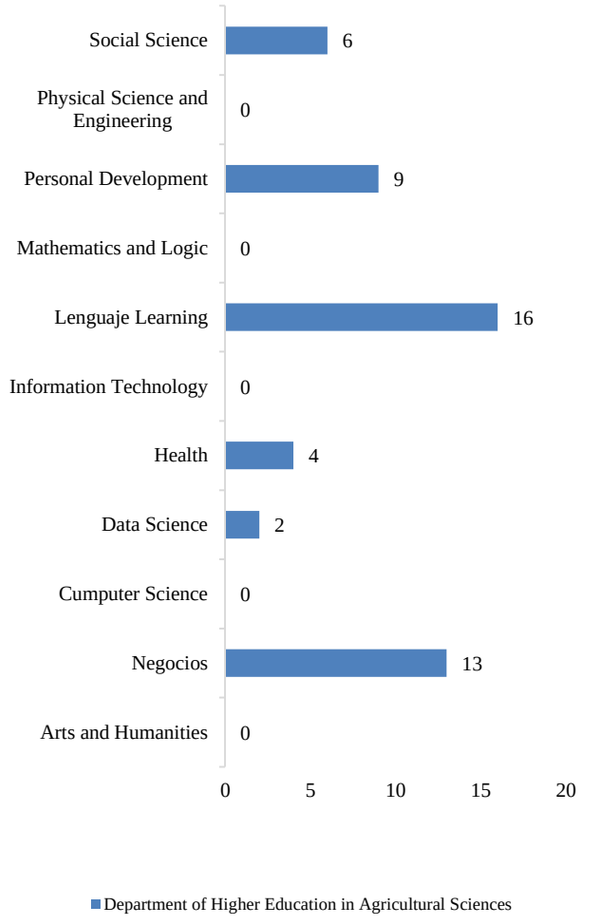
Department of Higher Education in Agricultural Sciences

Finally, we have the Department of Agricultural Sciences, although some areas of knowledge benefited the curriculum, it is observed that more courses are needed to complement the knowledge of the curriculum for this Faculty. Figure 4 shows the list of completed courses that benefited the curriculum of the Faculty of Agricultural Sciences.



Graph 3 Number of courses according to area of knowledge by Faculty of the Health Sciences DES on which they have an impact
Source: Own Elaboration



Graph 4 Number of courses according to area of knowledge by Faculty of the Health Sciences DES on which they have an impact
Source: Own Elaboration

Conclusions

The results show that despite being confined by Covid-19, the university community has the interest to continue learning and the desire to improve itself. It is important to highlight that this virtual platform is also free of charge, so it does not incur expenses for the university community.

The area of Language Learning had an impact on all the educational programmes, as the importance lies in the fact that we currently live in such a globalised world that the increase of companies in other countries and the migration of workers means that large companies have multicultural work teams made up of people from different countries and cultures, which is why the command of several languages is important for a professional career, which is why they all consider learning a second language.

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The business area is the one that has had the greatest impact on the educational programmes, with a total of 42 courses related to 12 educational programmes.

This is due to the fact that the institution seeks to train highly competitive professionals in a globalised environment who base their actions in the administrative and financial areas, as well as having the mentality and characteristics to start a business in order to contribute to the sustainable development of the State of Campeche. It is also worth highlighting the courses in the area of social sciences that benefited 24 educational programmes, since the aim is for the university community to learn to value culture and traditions, to assume a social conscience of the environment, as well as to develop a more democratic mind with the objective of contributing positively to society.
It is suggested for future research to review which courses were drop-outs in order to carry out a detailed analysis and an in-depth description of the participants' perspectives, in order to better understand the ways in which they participate in this educational modality.

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Leadership development in initial teacher training

Desarrollo del liderazgo en la formación inicial docente

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Abstract

This research focused on analyzing the development of the most relevant leadership competencies for the initial teacher training of future education professionals through a systematic review. The development and formation of leadership competencies in education is a relevant topic which must be investigated. Since the role of teachers is fundamental for the formative processes of the students, leadership competencies must be developed in their initial training. The training processes include both the knowledge that students must acquire according to the curriculum, as well as the development of skills that help them grow as individuals. The research problem focused on the need to develop leadership skills in the initial teacher training that allows them to perform comprehensively in their professional life in the field of education. The purpose was to analyze the development of the most relevant leadership competencies for the initial teacher training of future education professionals through a systematic review. It was demonstrated with this research that the competencies of leadership, communication, emotional intelligence and teamwork are the most relevant for initial teacher training. In addition, the contribution that the development of these competencies in the initial training of education graduates has on professional performance was confirmed.

Pedagogical and/or Educational Leadership, Leadership Competencies, Communication, Emotional Intelligence, Teamwork

Resumen

Esta investigación se enfocó en analizar el desarrollo de competencias de liderazgo más relevantes para la formación inicial docente de futuros profesionales de la educación mediante una revisión sistemática. El desarrollo, formación de las competencias de liderazgo en la educación es un tema relevante el cual debe ser investigado. Siendo el rol de los docentes fundamental para los procesos formativos de los estudiantes se deben desarrollar competencias de liderazgo en su formación inicial. Los procesos formativos incluyen tanto el conocimiento que deben adquirir los estudiantes según el currículo, como el desarrollo habilidades que los ayuden a crecer como individuos. El problema de investigación se centró en la necesidad del desarrollo de competencias de liderazgo en la formación inicial del docente que le permita desempeñarse de manera integral en su vida profesional en el campo de la educación. El propósito fue analizar el desarrollo de competencias de liderazgo más relevantes para la formación inicial docente de futuros profesionales de la educación mediante una revisión sistemática. Se demostró con esta investigación que las competencias de liderazgo comunicación, inteligencia emocional y trabajo en equipo son las más relevantes para la formación inicial docente. Además, se confirmó la contribución que tiene en el desempeño profesional el desarrollo de estas competencias en la formación inicial de los egresados de educación.

Liderazgo Pedagógico y/o Educativo, Competencias de Liderazgo, Comunicación, Inteligencia Emocional, Trabajo en Equipo

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1. Introduction

The topic of leadership development in education, training and leadership competences has been relevant, as shown in the various research carried out on the subject, such as: Álvarez-Botello, Torres-Velázquez & Chaparro-Salinas (2016) argue that "developing pedagogical leadership in a quality management project requires both the desire to exercise such leadership and the possibility of carrying it out" (p. 55). For Ramírez-García, González-Fernández, & Salcines-Talledoc (2018) "the acquisition of competences by future teachers requires a transformation in the preparation of teachers and university students..." (p. 263). In turn, Criollo (2018) argues that "teacher training is key in the performance of their work, the competences with which they are professionalised imply that they have the basic tools that are indispensable to face the task of teaching and learning" (p.3).

Also in publications such as Hackman and Johnson (2018) "historians, philosophers and social scientists have been trying to understand and explain leadership for centuries" (p. 2). Chiavenato (2017) indicates that "various theories or approaches have emerged that demonstrate the complexity of the subject" (p. 222). However, since leadership is a topic that intrigues many, researchers limit themselves to the discipline in which they work.

Likewise, Contreras, Barbosa & Piñeros (2016) point out that the study of "leadership is more relevant today than ever before more relevant than ever, research on the subject continues to grow and in an increasingly interdisciplinary way" (p. 222). These authors mention the importance that the study of leadership has had in order to understand the effects it has on management, education and individuals. This allows for a literature review of articles and scientific research related to the concepts of leadership, pedagogical and/or educational leadership, leadership competences in initial teacher education. Leadership is "transcendental for the well-being and subsistence of a group, organisation or society" (Hollander, 2009, p. 7), contributing to the achievement of their goals. This is confirmed by Betancourt (2017) who argues that leadership is a tool for change that can be seen as the art of leading people.

The research entitled Characteristics of the Effective Leader according to Experiences of University Students, is related to leadership in organisations that shows "the importance that studies on leadership have had, it is necessary to promote it both in Higher Education Institutions and in schools" (Reyes, Chávez & Guevara, 2017, p. 14). While Kumar and Fahimirad (2019) mention "the importance of integrating programmes that help the development of personal and social competency skills in students" (p. 77). The research consulted related to education shows the importance of including leadership in the training of future teachers as stated by: Bauzá-Vázquez and Bello-Rodríguez (2016) who highlight "the determination of the needs for the development of educational leadership constitutes a premise in the elaboration of training programmes in order to achieve a better direction of this process from them" (p. 102).

According to Criollo (2018) "teachers need training in: competencies in the area they teach, pedagogical competencies based on the fulfilment of learning standards, cultural competencies, continuous training and professional development, leadership, ethical commitment and vocation" (p. 4). Competences are "specific knowledge: knowing, knowing how to be and knowing how to do; which are the indicators of student performance, they are the capacities formed in knowledge, skills and abilities; attitudes and values" (Huerta, Penadillo & Kaqui, 2017, p. 89). The curriculum is considered "the basis on the expectations and demands outlined by society and the learning and development needs of students" (Chuquilin & Zagaceta, 2017, p. 115).

The process of curriculum construction “allows the integration of performances with specific competences, followed by competence units, training modules or subjects and competence elements or capabilities" (Huerta *et al*., 2017, p. 102). The authors Iranzo-García, Camarero-Figuerola, Barrios-Arós, Tierno-García & Gilabert-Medina (2018) subscribe "leadership competence is understood as the development of functions that allow setting directions and being a reference, motivating and involving" (p. 42).

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For Roca and Alonso (2017) "One of the requirements that education students should have in their initial training is the development of appropriate pedagogical leadership". In addition, they mention that the creation of programmes that help the development of these competences in education students should be considered. Vargas (2018) stresses "leadership should be considered as a process within the organisation that contributes to energising, influencing and supporting the entire community involved to improve the internal capacity for improvement, this implies that the leader affects and is affected by his or her followers" (p. 19).

Roca *et al*. (2017) also state that "student leadership should be included in the initial training process, it is relevant so that they can be pedagogical leaders during the performance of all their educational work" (p. 3-4). In other words, "leadership is not only a competence for those who run an educational institution, it is for everyone involved in educational processes, principals, coordinators and teachers" (Sierra, 2016, p. 122). The development of leadership in future teachers will enable them to be effective leaders and thus become educators who transmit knowledge, values and in turn motivating agents of change. Kendal and McDougall (2019) express that the figure of the teacher continues to be essential for the integral formation of the individual and in the construction of their self-ethnographic narratives (cited in Del Campo-Ponz, Chisvert-Tarazona & Palomares-Montero, 2019, p. 425). The changes that are taking place in the 21st century "(social, political, economic and cultural) demand changes in the professional profile of the teacher" (Criollo, 2018, p. 3). Therefore, conducting this research is important so that future teachers can identify, know and develop leadership competences before entering the world of work.

2. Methodology

The research was carried out using systems thinking as a theoretical framework to investigate the link between leadership, pedagogical and/or educational leadership and leadership competences specifically in initial teacher education. This was carried out with a systematic review approach, an exhaustive search of scientific literature was carried out, as well as an analysis of research and articles, obtaining different perspectives and updated information to strengthen the research.

The systematic review as a methodological approach, in accordance with the Cochrane Handbook (2011), makes it possible to identify recent information according to the previously established criteria and to analyse each of them. In turn, it supports the search for answers to the research questions in relation to the problem statement, which is the omission of courses that develop leadership competences in initial teacher training. According to Hernández, Fernández & Baptista (2016) the design of systematic reviews "highlights the use of certain steps in the analysis of data and is based on the procedure of Corbin and Strauss (2007)", p. 473.

By means of the systematic review it is possible to search for recent research and obtain up-to-date information on the topic to be investigated "Relevance of Developing Leadership Competences in Initial Teacher Education". This allows for an exhaustive search and analysis of primary sources, obtaining different perspectives to strengthen this study, taking into account that the purpose is focused on assessing the relevance of leadership competences in initial teacher education. The questions guiding the systematic review of the literature are as follows:

1. Are communication, emotional intelligence and teamwork the most relevant leadership competences for initial teacher education?

2. Why should the development of leadership competences: communication, emotional intelligence and teamwork be included in initial teacher education?

3. Why would the professional performance of education graduates benefit from the development of leadership competences: communication, emotional intelligence and teamwork in their initial teacher education?

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It should be noted that 190 primary studies were used, including databases such as Educational Resources Information Center (ERIC), Elton B. Stephens Co. (EBSCO), PROQUEST and others. Other portals such as Wiley Blackwell Publisher, Google Scholar, Scielo, Dialnet, among others, were accessed directly to access information in both Spanish and English and scientific, professional and educational journals.

A research protocol was established to optimise the search for relevant research, dissertations and articles using the Cochrane Handbook of Systematic Reviews of Interventions, translated by the Iberoamerican Cochrane Centre (2011). A comprehensive search for primary studies on the Relevance of Developing Leadership Competencies in Initial Teacher Education was conducted. The Cochrane Handbook (2011) systematic review methodology used in this protocol allowed for a specific, rigorous search of the most relevant studies and existing information.

Study Selection

According to the Cochrane Handbook of Systematic Reviews of Interventions, translated by the Iberoamerican Cochrane Centre (2011) the selection of studies should answer the research questions. They were initially screened for title, abstract and references, then assessed according to the inclusion and exclusion criteria mentioned below. It was established whether these met the conditions of being articles, research and dissertations on the topic to be studied. This was done by taking into consideration the documents related to the research problem, where the primary sources that will serve to obtain the data for this research were selected. Filter experts. The experts were in charge of evaluating the quality of the selected studies, in order to ensure that the data obtained would contribute to the research.

Eligibility Criteria

The process of searching for the papers selected for this research began by establishing the parameters of eligibility. We proceeded to establish whether previous research had been conducted on the same research topic, in order to obtain reliable sources and determine the inclusion and exclusion criteria based on these data.

After the search, no research was found on the topic of this research, the Relevance of Developing Leadership Competencies in Initial Teacher Education. The Cochrane Handbook of Systematic Reviews of Interventions, translated by the Iberoamerican Cochrane Centre (2011) establishes that the selection of primary studies must answer the research questions and meet the inclusion and exclusion criteria, detailed below, which are important in any systematic review.

For the purposes of this research, the following eligibility criteria were used: 1. The studies to be examined for the systematic review were primary studies conducted during the years between 2016 and 2021. 2. The papers considered included at least one of the two variables of this research. 3. The studies included active teachers and students of the education programme and educational institutions and were written in Spanish or English. 4. The selection was made through searches in databases, books, degree theses, and journals in the field of education. The search was oriented towards refereed articles, preferably published, due to the broad scope of a systematic review, the search for studies was not limited in terms of the methodologies used in them. Inclusion and exclusion criteria were applied as detailed below.

Inclusion and Exclusion Criteria

According to the Cochrane Handbook of Systematic Reviews of Interventions, translated by the Iberoamerican Cochrane Centre (2011) it is important that inclusion and exclusion criteria are established in a systematic review. These should be specific to the research topic. Inclusion criteria allow to determine which papers are part of the study and exclusion criteria allow to promptly discard those papers that meet these criteria.

Inclusion Criteria

The search criteria were related to the research questions related to the research topic Relevance of Developing Leadership Competencies in Initial Teacher Education. Articles and research related to the area of education on the development of leadership, communication, emotional intelligence and teamwork competences in initial teacher education were used. These were published in the period from 2016 to 2021.

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Exclusion Criteria

Articles or research that presented any kind of bias and published in languages other than Spanish and English were excluded. Studies that were too long or too broad in terms of the research topic were also excluded as they made it impossible to draw appropriate or usable conclusions.

Instruments

The instruments used were designed by the author using the Cochrane Handbook (2011) instruments as a model, these are:

Checklists for Assessing and Selecting Sources

These lists are used to define the established inclusion and exclusion criteria, with which a critical review is made of each of the primary sources, their content and the value they add to the dissertation. It includes the title of the research, author(s), date of publication, type of publication (dissertation, research, article), database and keywords. The criteria are: timeliness: indicates the period in which the study was carried out, which should not exceed six years; reliability: makes it possible to verify the information in the database; sources of information: corresponds to 100% primary sources; scope of the study: determines the level of complexity of the primary source (level of specialisation). It has a section to identify whether or not the study meets each of the criteria and to note observations.

Matrix for the Organisation of Information

This matrix integrates elements such as the identification of the source including the title of the research, author(s), date of publication, type of publication (dissertation, research, article), database. The criteria for evaluation are the methodology used in the research, the contribution it will make to the research, the main results and the conclusions.

Description Matrix for Evaluating and Selecting Primary Sources

In this matrix, information from each of the sources that are closely related to the content of the research topic is classified at the next level.

It includes the title of the research, author(s), date of publication, type of publication (dissertation, research, article), database and keywords. The criteria for evaluation are the methodology used in the research, the contribution it will make to the research, the main results and the conclusions.

Summary Content Sheets

In these sheets, the aspects that identify each selected study and a brief summary of its content are indicated. The purpose of these sheets is to store the information consulted and analysed, which allows for the systemic review of the literature related to the research. It includes the title of the research, author(s), date of publication, type of publication (dissertation, research, article), database and keywords. It has a section for personal commentary and peer review.

Checklist for Filtering Experts

The information and assessment made by the experts selected to act as filter experts for this dissertation is presented. Thus, the filter experts play a key role in analysing each of the primary sources cited, and then reviewing which ones do or do not contribute to the research. It includes the title of the research, author(s), date of publication, type of publication (dissertation, research, article), country where the research was conducted and database. The assessment criteria are: it is related to the title, identification of the authors, the database is academically recognised, the time of publication is as established, it identifies the country where the research was carried out, it meets the assessment and selection criteria, reliability, sources of information, scope of the study. It has a section for the filtering expert to mark whether it complies or not, to write comments and/or suggestions and to sign.

3. Results

The results obtained in relation to the most relevant leadership competences for initial teacher education found that communication competence is necessary to try to improve pedagogical tasks in the classroom. Communication skills must be developed during initial teacher training in order to foster efficient communication.

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Through communication, trust is established between the teacher, students and the school communicated. Communication has the power to build educational projects through teacher/student interaction. Communication is necessary as a tool in the teaching-learning process. Its function is to transmit clear, understandable and motivating messages, so the future teacher must have developed this competence.

Emotional intelligence in future teachers is insufficient for them to cope with challenges and responsibilities, especially those working with young children. It provides the teacher with an understanding of emotions and how they can positively or negatively affect decision-making.

Teamwork should be considered as a necessary competence for teachers to develop, as they should be facilitators of cooperative processes in the classroom. This competence enables students to develop the social competences needed both in the school environment and in their future work, so the teacher should be a facilitator for the acquisition of this competence.

The results show that the development of leadership competences: communication, emotional intelligence and teamwork should be included in initial teacher training were as follows: Communication favours interpersonal relations, so it should be developed in future teachers so that they can have good relations with both their students and their peers. The teacher as a leader needs this competence in order to increase the performance of his or her students.

The teacher should possess these competences that will help him/her to foster and increase the performance of his/her students. It is also through communication that teachers foster the holistic development and understanding of their students in the classroom. This in turn will lead to academic achievement. Communication skills in education students are limited and this is a challenge for the training of future teachers. This will affect effective communication in the classroom. Future teachers are the ones who construct knowledge and interact with students, so the development of this competence is crucial in their initial training.

Emotions enable self-knowledge for both personal and professional growth. The teacher is conceived as a guide, motivator and facilitator, so possessing the competence of emotional intelligence is important. Emotional intelligence should be recognised as an essential component of the teacher's skill set. In future teachers this competence is necessary for them to be able to cope with the challenges and responsibilities of classroom work. It also directly or indirectly influences their behaviour in the classroom and with students. Teacher education should include more training on emotional self-assessment and emotional intelligence. School districts should offer professional development for teachers and use it in teacher recruitment and retention.

It is important for teachers as facilitators of instruction to develop the competence of teamwork, which will give them the tools for their students to develop this skill in turn. Teamwork is a complex and relational experience. It is important for teachers to be aware of the skills that students will be exposed to through teamwork, so it should be included in their initial training.

The results obtained in relation to the benefit of developing the competences of communication, emotional intelligence and teamwork in the professional performance of education graduates were: communication competence is important for the adequate performance of teachers both in the classroom, meetings and as tutors. Emotional intelligence helps to increase the effectiveness of the teacher's work both in the classroom and in the school community. It impacts teachers' skills, attitudes and knowledge for effective performance. School districts should add elements of emotional intelligence to assessment standards to ensure a healthy school culture.

4. Conclusions

Based on the purpose of this study to analyse the development of the most relevant leadership competences for the initial teacher training of future education professionals, as well as the research problem of the need to develop leadership competences in initial teacher training that will enable them to perform in a comprehensive manner in their professional life in the field of education, the implications of the results of the systematic review are outlined below.

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Effective communication is having the ability to listen and understand all incoming information and/or data. Communication competence equips teachers with personal skills necessary for their work in the classroom. It will also help them to communicate effectively with their students and colleagues.

The teacher through communication brings the information to their students in a clear and concise manner, this prevents the student from not understanding the material being taught. With the teacher's mastery of this competence, a conducive teaching environment is created. Effective communication promotes student learning; without it, academic achievement is affected.

The development of a teacher's communication competence is key to student participation in learning and assessment. Teachers need to master this competence so that they can listen to students and build students' confidence. This teacher-student interaction encourages participation in the classroom and helps students to develop this competence as well. Communication is a key competence for teachers.

The development of this competence in initial teacher education will enhance student participation in the classroom and learning. Learning communication skills will help teachers to be more effective and productive in their work as educators. It also helps them to optimise communication among their peers, parents and the school community. The development of this competence is not included in the curriculum of education programmes and university students do not have adequate communication skills, it is worthwhile to include it in the curriculum of the education programme. Therefore, educational institutions should encourage the development of this competence in initial teacher training as a crucial tool for pedagogy and performance.

Emotional intelligence competence helps teachers to manage their emotions, as well as their students to learn to control their emotions. To the extent that teachers gain control of their emotions in front of students and their peers, it will have a positive effect on students' academic and learning development.

Likewise, developing emotional intelligence in initial teacher education is key to the teacher-student relationship and learning. It also helps them to understand how emotions positively and/or negatively affect the cognitive and emotional processes of their students. Promoting the teacher's emotional intelligence competence will develop self-control, motivation, empathy, perseverance and conflict management skills necessary for effective work in the classroom. It is necessary for teachers to develop emotional intelligence so that they can promote positive thinking in the classroom. Enthusiasm and perseverance will be reflected in lesson planning to achieve academic goals. Educational institutions must understand the need for the future teacher to understand how complex emotions are and how they influence and/or affect cognitive processes. It is therefore important and necessary to include this competence as part of initial teacher education.

Teamwork involves competences needed to be developed in students. By usage and custom both teachers in universities and schools use it to assign a task to be done in a team, but this activity does not foster the development of teamwork competences. Teamwork is an activity to be carried out in the classroom with the participation of the teacher to enable students to participate and help them in the development of this competence.

When teachers have mastered this competence they aim to improve their students' learning by using teamwork. Through this competence, social relations, communication, decision making, conflict management among students are fostered. Skills that will benefit students in their academic, personal and professional life. Developing interpersonal competences in students should be one of the teacher's goals. Interpersonal competences contribute to developing empathy, cooperation, conflict management and working with different personalities, races, creeds, sexual orientation. In turn, teamwork competence fosters commitment, respect and empathy of team members. This will enable students to deal with conflict situations both in the school environment and in their future work. When teachers are aware of the importance of developing these skills in students, they will establish the methodology to foster these skills in their students.

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Personal and social skills are necessary to enable the future teacher to have healthy relationships with both peers and students. It can be seen that this competence should be fostered from initial teacher training in order to reinforce interpersonal skills, motivation, communication, decision-making and conflict management. In addition to promoting the adequate performance of teachers. As can be seen, this competence increases decision-making, which is important for future teachers to develop professionally. In spite of the competences necessary for the teacher to develop through teamwork, this is not a subject that has been researched much. Therefore, it is concluded that the competences of communication, emotional intelligence and teamwork should be included in the curricula of education programmes in initial teacher training.

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History Teacher's Specialized Knowledge (HTSK)

El Conocimiento Especializado del Profesor de Historia (HTSK)

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Abstract

The work offers a first approximation to a theoretical-analytical model for the recognition and understanding of the History Teacher's Specialized Knowledge (HTSK). In the article, it is based on a justification that in a first order considers the advances that are considered in the didactics of mathematics and; although the substantial differences between both disciplines are recognized, the advances of one are also assumed, for the construction of the first model of the other. Mathematics Teacher's Specialized Knowledge (MTSK), the didactics of history and a lesson plan for teaching history were considered to visualize the evidence of that particular and specific knowledge that a teacher reveals when teaching history. and that this is precisely what makes it a specialized knowledge.

Knowledge, Specialized, Teaching, History

Resumen

El trabajo ofrece una primera aproximación a un modelo teórico- analítico para el reconocimiento y comprensión del conocimiento especializado del profesor de historia (HTSK) por sus siglas en inglés. En el artículo, se parte de una justificación que en un primer orden considera los avances con los que se cuenta en la didáctica de las matemáticas y; aunque se reconocen las diferencias sustanciales entre ambas disciplinas, también se asumen los avances de una, para la construcción del primer modelo de la otra. Se consideró el conocimiento especializado del profesor de matemáticas (MTSK), la didáctica de la historia y un plan de clases para la enseñanza de la historia para visualizar la evidencia de ese conocimiento particular y específico que pone de manifiesto un profesor al momento de enseñar historia y que ello, precisamente es lo que lo hace un conocimiento especializado.

Conocimiento, Especializado, Enseñanza, Historia

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Introduction

The analytical-theoretical framework of specialised teacher knowledge, especially in mathematics, already has a long tradition of research (Climent, *et al*., 2014) and important contributions that allow it to develop didactic and disciplinary perspectives with very well-founded bases. The contributions in the area of specialised knowledge of the teacher, as well as in mathematics didactics, transcend from different frontiers and perspectives that have years of research work, on mathematics didactics it is enough to observe the contributions of the French school and the great advances that have been made since the end of the last century by researchers such as Yves Chevallard or Guy Brousseau and on the side of specialised knowledge, the contributions with the investigative views of Shulman, Ball and Carrillo.

These researches have enriched the analytical, theoretical, specific frameworks of didactic planning devices (The Theory of Didactic Situations -TSD-), even methodological ones, for example "Didactic Engineering" by (Artigue, Douady, & Moreno, 1995), Of course, this has been reflected in the didactic and curricular proposals of study plans and programmes, as well as in the specific didactifications that teachers plan to develop their classes in schools, and even in the analytical approaches to characterise and better understand professional practice.

However, the analysis of this argumentative work does not intend to increase the already specialised view of the work on the didactics of mathematics. This perspective is taken up again with the intention of giving a twist and an enriched look at what has been argued in the didactics of history. Above all, the aim is to carry out a theoretical analysis of the state of the art in the didactics of history and to link it to the theoretical and analytical framework of the mathematics teacher's specialised knowledge (MTSK), in order to begin to characterise a first model of the History Teacher's Specialised Knowledge: History Teacher's Specialized Knowledge (HTSK), which furthermore concretizes in a complementary view between the contributions of MTSK towards HTSK and looks at how HTSK, can influence specific training tasks in future teachers who teach history.

The analytical power demonstrated by MTSK has attracted the attention of researchers interested in exploring teacher knowledge in other disciplines, and the extension of the model to these disciplines has been considered. Thus, progress has been made in characterising the specialised knowledge of biology teachers (Luis, 2021). There are also research groups interested in characterising the specialised knowledge of physics, chemistry and language teachers. This extension of the MTSK model to other disciplines implies no minor challenges in its conceptualisation (Montes & Climent, 2022, p. 339).

In the above quote, the authors mention the analytical and comprehension possibilities that the MTSK model has given to specialised knowledge in order to transfer it to other disciplines, however, in the same text, they mention no minor challenges that must be seriously considered in order to think of a model that tries to express analytically the domains and sub-domains that can comprise some other discipline.

One of these challenges is found, according to (Montes & Climent, 2022), in the specificity that this specialised knowledge has with respect to the scientific discipline and its didactification, which is not a minor situation with respect to HTSK, given that history, a situation that will be examined in depth in the theoretical analysis that will be carried out in this text, is a social discipline with very specialised formative and scientific construction aspects that are different from other disciplines.

However, (Montes & Climent, 2022) give a guideline that served for the consolidation of the MTSK, thinking about the possibility of transferring these activities to other disciplines in the search for specialised knowledge for the specific case. They propose relating it to a knowledge of the subjects of the discipline that is local to the discipline and the level at which it is being analysed; a structural analysis of this knowledge was also carried out, and a bibliographic search on the discipline was also contemplated. Situations, all of them, that will be addressed for the intention of generating the HTSK.

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On the other hand, and without forgetting the specifics of the historical discipline, we will start from the current construction of the domains and sub-domains that are already contemplated in the MTSK scheme, we will consider their similarities with the specialised knowledge of a teacher who teaches a subject other than mathematics, but above all, we will seek to build a specific model that responds to the characteristics demanded by the didactics of history.

With specificity, we will break down the teaching tasks set out in the 2018 Primary Education Graduate Studies Plan, specifically in the courses related to history, and we will also carry out an analysis from a planning point of view for the teaching of history content; This relationship will be sought with the possible domains and subdomains constituted from the MTSK, however, modifying the perspective according to the specificities that involve the teaching of history, in order to concretise a model that is specific to the intentions, tasks and Specialised Knowledge of the History Teacher.

Some advances in History Didactics

The argumentative work that is being constructed in no way intends to be an exhaustive study of the diverse and important lines of progress in research and didactics of history, nor does it intend to be seen as a validating text that evaluates or generates any kind of validation of the didactics of history. What it does aspire, especially in this part of the advances with respect to the didactics of history, is to make a compilation and analysis of perspectives and various positions that have been built around the didactics of history in order to generate a vision that allows the construction of a proposal that links the categories of specialised knowledge of the teacher with that same knowledge, but aimed at the teaching of history. (Henríquez & Pagés, 2004) in the study they carried out on a review of research in history didactics, made a classification of the research works around the characteristics of historiographical studies that contribute to the disciplinary knowledge of historical knowledge and on the other hand, to what the authors conceptualise as the psychology of the processes of instruction; the work also argues about the studies that are directed towards the teaching or learning of history.

Regarding the teaching processes in history, Bain (1997, 2001) cited by (Henríquez & Pagés, 2004) mentions as a problem that "many teachers, not being familiar with the emerging epistemological contributions of the area of social science didactics, teach history using taxonomies in which historical knowledge is diluted in generic concepts that apply to all school disciplines" (p. 66).

This aspect is worrying and is a first point of reference for specifying the relevance and urgency of characterising and generating a model of the specialised knowledge of the history teacher. The initial expectation of the analytical model would be to show the didactic and disciplinary aspects that are evident in the professional practice of teachers who teach history, thus acquiring awareness of the didactic intentionality.

According to (Pantoja, 2017) history as a formative social subject has the fundamental premise of knowing and teaching history as two processes that are at the same time complementary and distinct. This argument can be transferred to the case of the Specialised Knowledge of the History Teacher, in the two primary domains of such specialised knowledge: historical knowledge and didactic knowledge of the content. So, with respect to the advances already available in the perspectives of history didactics, one of them is this first characterisation.

What is the disciplinary knowledge that a teacher who teaches History should have? To what degree of specialisation should the curriculum contemplate in order to train teachers to teach History in Mexican primary schools? On the other hand, what are the specificities that are considered when talking about the didactics of History?

These are some important and unavoidable questions for the continuity of the didactics of history, hence the need for a model that envisages a greater specificity in the specialised knowledge of the history teacher, a model that allows a look with more precise characteristics on what to teach and how to do it.

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The arguments and questions presented up to this point lead us to differentiate between teachers who develop their professional practice in the teaching of history in primary education and teachers who teach history at later levels. In addition to teaching history, the former's professional practice also includes other subjects that are part of the country's basic education system, such as Mother Tongue, Mathematics, Natural Sciences, Geography, Civic and Ethical Education, Art Education, Social and Emotional Education, and even in some schools (especially multi-grade schools) Physical Education and English.

This situation leads us to visualise the degree of specialisation that primary education teachers contemplate for their practice when developing their history classes, as well as the specialised knowledge provided by the generalist didactics of the whole curriculum that their practice contemplates. This will be the subject of analysis in another text, however 1. it should not be left aside, given that it influences the degree of specialised knowledge that is observed when teaching history and; 2. for the present analysis and despite confirming the influence of generalist practice in primary education, it is clear to us that when teaching history it highlights a specific specialised knowledge of history, a situation that we are trying to demonstrate, expose and explain in the present work.

In studies such as that of (Gómez, 2013), it is argued that teachers who have graduated from a Bachelor's Degree in History have a routine and traditional practice, a situation that leads the author to wonder about the skills that are involved at the time of teaching practice. In this regard, the author distinguishes four fundamental skills for the development of adequate history teaching: disciplinary knowledge, didactic knowledge, contextual knowledge and strategic knowledge.

The distinction made by (Gómez, 2013) includes disciplinary and didactic knowledge, which will also be determined in the HTSK model, but also includes contextual knowledge which implies knowledge of the environment, of the field in which the teacher's practice takes place, and strategic knowledge which refers to the teacher's ability to integrate the three previous knowledge in the best way possible,

However, although from the perspective of the present analysis, it is not intended to criticise any other perspective, it is important to delimit the intention of the HTSK towards the specificity of the knowledge of historical content and the didactic knowledge of historical content, as the two fundamental bastions of teaching practice when teaching history, and we will try to delimit these two with greater specificity.

Generalist professional practice -which is the one that manifests itself in primary education teachers who teach several subjects- allows the development of knowledge that transcends the specialised knowledge of any subject (Lizarde, Hernández, & Loera, 2015), in such a way that pedagogical knowledge (Shulman, 1986) is formed that supports the management of the teaching and learning process with a general view but that allows specification in different subjects. That is to say, for example, the epistemological view of Constructivism can be used by teachers to create their lesson plans in Spanish, Mathematics or History.

However, there are also specificities and characteristics that are very specific to the teaching and learning of these subjects, and for this reason, it is argued that it is pertinent to characterise the specialised knowledge of the history teacher that makes his or her practice in this subject specific and that therefore requires an analytical model that observes its particularities.

Theoretical Perspective of History Didactics

This paper recognises that didactics, as a field of knowledge, can deal with pedagogical practice without losing its potential to construct itself as a scientific discipline on the basis of constant epistemological vigilance that makes it possible to differentiate between the common or spontaneous knowledge that teachers and students may possess and scientifically constructed knowledge (an educational task that is more complicated than for the exact sciences and an aspect that differs in the proposed model of the HTSK). In this sense, didactics is responsible for regulating the teaching and learning processes on the basis of a theoretical basis and from the interrelation of three epistemological aspects: teacher, student and learning context.

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Based on this position, didactics is assumed to be a science, so that it is possible to produce scientific knowledge in this field of knowledge and, on this basis, we now explain the position taken with respect to the teaching of history and its epistemology.

To do so, first of all, it is recognised that the history teacher should not be oblivious to the contributions of the discipline of history and its own epistemology, since it is this that provides the concepts and methods that have to be brought into the classroom firstly to identify how their students produce their own historical knowledge, in order to subsequently encourage them to produce it through the processes that the discipline provides; Likewise, by recognising the scientific nature of didactics and, therefore, of the didactics of history, it is important that the teaching of history encourages students to interpret the past, the present and make decisions about the future, from a critical stance that can only be assumed in formal education.

In this sense, teaching is a complex object of didactics, since its phenomena (purposes, contents, teachers and students) are interrelated. Specifically in the teaching of history, this becomes more complex as it deals with abstract knowledge which, unlike the exact sciences, can only be manipulated through methods and sources or testimonies based on a clear historiographical position.

In congruence with the above, the teaching of history should seek to develop concepts that function as tools of thought. In this regard, the contribution of Arteaga and Camargo (2014), who, from the field of history education, take up the model of historical cognition developed by Peter Seixas together with other researchers in Canada and introduce it in Mexico for the initial and continuous training of Basic Education teachers, is considered valuable.

The concepts they propose are called first and second order concepts. The first-order concepts "... refer to the specific meanings of some conventional terms or terms used with different connotations in other areas of social and humanistic knowledge, such as "Revolution", "State", "King", "Independence", "Ruler". The second-order concepts, which help to develop cognitive skills, are:

1. Historical time: "...always implies a relationship between space and time, since both dimensions are inseparable. And it is these coordinates that allow us to situate a given process in history...".
2. Change and continuity: "...it is relevant to associate the notion of historical time with the notion of change and continuity by asking questions such as: What changes, how, were the changes slight or profound, what things remained, how can we know, how can we know? These questions guide the understanding not only of changes, but also of their rhythms and directionality, since changes can occur in different directions. There is not only progress, there is also decline, regression, crisis, among others. Understanding this implies recognising the complexity of historical transformations.
3. Empathy: "It is associated with the assumption that people who lived in the past did not think or act as we do and, for this reason, when explaining the processes they took part in (...) it is necessary to do so in the light of their own context and in the political, intellectual, and cultural frame of reference of that context and not from our own frame of reference".
4. Causality: "It is associated with that of change insofar as it is identified with processes that break with the continuum of everyday life. However, the causes that trigger these processes are not "links" in linear "chains" of events, but are part of complex networks that interact directly and indirectly simultaneously".
5. Evidence (primary and secondary historical sources): "...involves the conception of history as a discipline that allows us to learn about the past from material evidence and records of various kinds (primary historical sources), independently of the narratives or accounts that we can find in books, encyclopaedias, websites and others (secondary historical sources).

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6. Historical relevance: "allows us to get to know everyday life and historical continuity, local and regional history, as well as conjunctural or short-lived processes as issues worthy of being studied and recognised as historical objects susceptible of research (Arteaga and Camargo, 2014, pp.126-130).

In order to favour them, the teaching of history must change the protagonism of the teacher and the dominant use of the textbook, to give way to the creation of learning situations where the student consciously participates in his or her own learning process (Pagès, 2007). For this reason, it is considered that the teaching of history should have the following characteristics:

a) The school must overcome the teaching of a museum history, which represents historical time as an accumulation of data and dates.
b) The learning of historical time should be based on the relationships between past, present and future, on a personal and social level.
c) The teaching of history must be based on the present time and on the problems of the students, in order to educate them in democratic values.
d) We must question the temporal categories that are presented as natural categories, when they are social constructions.
e) We should not only teach a certain periodisation, but we should also teach how to periodise.
f) Chronology should be taught in relation to a series of basic temporal concepts, such as change, duration, succession, temporal rhythms or qualities of historical time.
g) Temporal concepts act as cognitive organisers, both in everyday events and in the process of understanding history.
h) Temporal thinking is formed by a network of conceptual relationships, where personal or historical events are placed in a more or less structured way (Pagès, J. & Santiesteban, A., 2010).

The tasks must be elements that go beyond what constructivism demands. That is to say, to advance conceptual, attitudinal and procedural contents where the task becomes a form of analysis of the historical context based on sources: both first and second order. Where students, based on the above, attempt and achieve representations of what has happened in recent and remote times, that is, learning in its totality, situated.

The History Teacher's Specialist Knowledge (HTSK). An Analytical-Theoretical Framework for Recognition and Understanding

On the basis of the arguments set out above, this section is constructed from the analysis of a lesson plan for the subject of history designed by a teacher in the process of initial training in primary education, specifically in the course "History and its teaching", which is being developed during the fifth semester of the Bachelor's Degree. This lesson plan will visualise the teaching tasks that arise for the training of the future teacher and the relationship between them in order to concretise an analytical theoretical model to characterise the specialised knowledge of the history teacher (HTSK).

Before starting with the specific training tasks that are observed in the lesson plan, as well as their derivation towards the domains and subdomains of the specialised knowledge of the history teacher, it should be made clear that this is a first approach to the characterisation of this specialised knowledge and that research and theoretical work will be necessary to allow greater depth and understanding of the model that for now is proposed and assumed as a first approach.

The domains of specialised knowledge of the history teacher

In the theoretical and investigative route that has been carried out in the present work, the consensus is observed with respect to the posture of consideration of the two fundamental aspects that are present in the teachers at the moment of carrying out professional practices around the teaching of history and that, from the model that is being proposed are categorized in two domains (Shulman, 1986): 1. The Historical Knowledge (HK) and; 2.

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Historical Knowledge (HK)

Historical Knowledge (HK) is assumed to be the knowledge of historical content, i.e. knowledge that from a scientific discipline is applied in a school context (Climent, *et al*., 2014); from mathematics (Ball, 2000) mentions that it is different from that required by any other professional or any other knowledge needed for everyday life, which makes it specific, a situation that is transferred to historical content knowledge and that likewise, it is assumed to be specific and particular and therefore, it is necessary to observe the approach that the teacher gives it (Climent, *et al*., 2014).

In the case of the lesson plan being used for this analysis, this is evident in the topic proposed in the planning: "The Mexican Revolution: Maderismo and the beginning of the Mexican Revolution. The development of the armed movement and the proposals of revolutionary leaders: Zapata, Villa, Carranza and Obregón", in the same way in the concepts that from the lesson plan are considered as the most important in the construction of the knowledge that is being proposed for the class session:

FIRST ORDER OR SUBSTANTIAL CONCEPTS					
Democracy	Opponents	Presidential succession	Candidate	Anti-reelection	Plan of Saint Louis
Government	President	Reelection	Presidential election	Law	Freedom
Supporters	Foreign businessman	Constitution	Revolution	Warlords	Constitutionalists (military group).

Table 1 Concepts characterised as part of the historical content knowledge to be developed

The image above shows the concepts that the trainee teacher anticipates in his or her lesson plan as those that will be studied and developed during the history session. This aspect shows the specialised knowledge of the history teacher which is constituted in this analysis, from a lesson plan. This domain contemplates more specific aspects that are called subdomains and even categories. For the analysis of this first approach, only the subdomains will be taken up again; in future studies, a more detailed and in-depth analysis will be carried out with respect to the categories that contemplate each of the subdomains, even from other contextual and investigative perspectives (from specific class sessions, for example).

The domain of historical knowledge and in relation to the proposal of the MTSK for mathematics, but in its proposal, projection and transfer to the HTSK, is subdivided into three subdomains for a better clarity in the specificity of this knowledge: Knowledge of Topics (KoT), Knowledge of the Structure of History (KSH) and Knowledge of Practice in History (KPH).

Knowledge of Topics (KoT)

Every teacher in the development of a didactic session with his students, evidences a certain mastery of the historical topics that he is going to develop with his students. This knowledge of topics is the teacher's intentional appropriation of that specific part of historiography, a scientific discipline, which he/she proposes in the teaching and learning process.

In the lesson plan that is being used to observe the formative tasks, it can be seen that the teacher trainee takes up the content of "From the Porfiriato to the Mexican Revolution", with activities such as: "From the Porfiriato to the Mexican Revolution", "From the Porfiriato to the Mexican Revolution":

This activity will be carried out together with the teacher and all the students so that the comic strip is developed according to the process shown in the textbook (Cutting out the lesson plan). This sub-domain places in the specialised knowledge of the history teacher and in the teaching tasks that form part of his or her training as a primary education teacher, the disciplinary knowledge that will be intrinsically present in the design and sequence of his or her didactic situations, in the explanations given especially at the end of the sessions.

This subdomain, considered from the characteristics of History as a scientific discipline, serves as an example of an important condition in the teaching and learning of history: conceptions, a condition that is part of the HTSK model and that is taken up from the MTSK Model (Carrillo, Climent, Conteras, & Muñoz-Catalán, 2013). For our model we argue the following:

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First. The teacher's conceptions are transcendent for all the subdomains that form part of the model, given that these conceptions determine, to a greater or lesser degree and with a certain degree of conscious intentionality, the contents, the perspective of the contents, the teaching strategies, the meaning of didactics, the management of teaching, etc. that will be developed in the classroom session.

Secondly. In the case of history, in its formative condition of citizens and historical-social subjects that are assumed in the curricula that propose its teaching and learning, in addition to the conceptions of the teacher, the perspective of the subject-citizen that is projected is also involved in the process.

Third. Then for the case of the HTSK model, conceptions cover a preponderant value, see the case of the subdomain that is being constructed in which a teacher, for intentional or unintentional reasons, can develop a certain perspective of history and discard another; therefore;

Fourth. For this model (and which will be a necessary situation to continue to deepen in subsequent studies) we transcend the use of the teacher's conceptions proposed by the MTSK and assume the Social Representations (Moscovici, 2003) as a theoretical construct that allows us to visualise, in addition to the conceptions, the common knowledge, the scientific knowledge, that is, all that social organisation around historical thought.

Knowledge of the Structure of History (KSH)

The construction of knowledge has a sequentiality, a structure that shapes it. Previous knowledge serves as a support for finding new meanings. That bundle of knowledge that "reveals teachers' understanding of the longitudinal processes... of learners" (Ma, 2010, p. 139). This sub-domain is manifested in the HTSK through the knowledge that the teacher considers in order to concretise a certain topic with his or her students, possible categories such as change and continuity of a historical process.

The knowledge package clearly exemplifies this longitudinal relationship that relates the complexity between different contents, in order to, from the mastery of a certain topic, strengthen the basis and structure to be able to develop other knowledge, a situation that the teacher who teaches history takes into account prior to the development of his didactic activities as part of his planning, within the class session, even to consider didactic variables that differentiate the learning achievement of his students.

Levels of cognitive-conceptual development of historical literacy		
Initial Personalized	**Developing sociopolitical**	**expected or complex chronological**
Feudal lord	Dictator	Prehistory
Slave	Cologne	Chronology
President	Absolute monarchy	Neolithic
Dictator	Independence	Before Christ BC
Nomadic people	Reform	After Christ AC
Sedentary people	Republic	Century
Half Blood	Empire	Decade
King		Lustrum
		Medieval
		Prehispanic
		Year

Table 2 Conceptual knowledge package on learning achievement of the historical content

The picture above shows the achievement of different conceptual levels that are expected to be developed with respect to the historical literacy that is proposed for the content that was worked on in the lesson plan presented. What this sub-domain demonstrates is the knowledge that structures a certain topic from the HTSK and that the teacher considers them in order to concretise a certain historical topic with his students.

Another example could be considered from the inductive vision of learning history that is promoted in different curricula for primary education students (SEP, 1993), (SEP, 2011), in which in the first grades, the topics are related to a knowledge of history closer to the subject, to the child himself, his personal history as the first vision, then his family history, to later transfer his historical knowledge towards the community, the federal entity, the nation and universal history. See the structure of history teaching as that general vision which is being consolidated and built in a back and forth of historical knowledge, between what the subject already knows and what is constructed in a significant way as part of that intentional and longitudinal structure to consolidate a new historical knowledge.

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Knowledge of Practice in History (KPH)

According to (Climent, *et al*., 2014, p. 78) "This subdomain highlights the importance of the teacher not only knowing established mathematical outcomes (knowledge considered in the KoT), but also the ways of proceeding to get there". By establishing the differences, but at the same time the corresponding analogy towards Historical Knowledge, this sub-domain marks the need to consider the ways and practices that are specific to historical knowledge, in order to construct it. This aspect is important, taking into account positions on the didactics of history which emphasise the pertinence of constructing historical knowledge, of seeking diverse and different first and second order sources in order to generate conscious and informed historical knowledge and not only consuming the knowledge which is pre-established in the formal curricular standards.

The position of the present argumentative work is reiterated in that it is necessary to detail the categories that will allow a vision with greater depth and specialisation on the HTSK, in this way it will be in all the subdomains, the present work is a first approach and some of the aspects that could be considered for the visualisation of the categories that will comprise it are shown, but for this first approach only some that are observed from the instrument that is taken up (the lesson plan) are handled.

The important thing for this first approach is to determine the need to consider the practices that are specific to historical knowledge for its construction and in this way confirm that it is a subdomain of the HTSK that the teacher takes up for the development of his professional practices when teaching history.

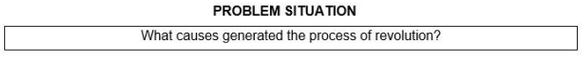

Figure 1 Knowledge of historical practice. Causes-Consequences

This practice is the consideration of causality or consequences in the study of any process of historical study.

This allows, from the study of history, to deepen, not only on the historical fact, but to be able to deepen from those factors that caused it (Causes), as well as the immediate and mediate repercussions, even as influence towards its actuality and that is part of the current conformation of some part of the society (Consequences).

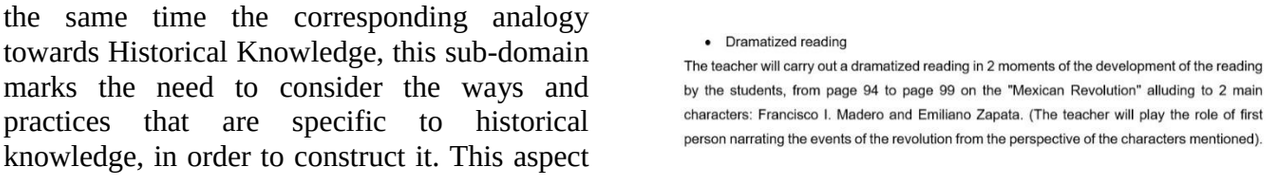

Figure 2 Knowledge of historical practice. Dramatisation

Another specific practice for the construction of historical knowledge that functions as an exemplification of the subdomain that is being put on the HTSK model is dramatisation. This practice makes it possible to didactify one of the most complex difficulties in the teaching of history. History is a discipline with great complexity in its learning, given that the subjects studied are facts that are part of the near or remote past. Authors such as (Pluckrose, 1993) and (Carretero, 1997) argue in their works about this difficulty in the teaching and learning of history, which is why the practice of building historical knowledge through dramatisation provides a teaching strategy that allows teachers to bring their students closer to the historical fact and to experience it in situ.

Pedagogical Content Knowledge (PCK)

The knowledge that makes the teacher's knowledge specialised is complemented by the Pedagogical Content Knowledge (Shulman, 1986) (PCK). This second domain of the HTSK, which is also part of the MTSK, is that particular knowledge that makes the teacher's knowledge specialised.

Analyses such as that of (Lizarde, Hernández, & Loera, 2015) show the difference that exists between the knowledge of a specialist, for example in history, and the knowledge of a teacher who teaches history, which is also specialised knowledge.

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The latter, precisely, is strengthened in the practice of teaching, not only by the knowledge of the historical and specific content of the educational level and context in which it is found, that what to teach and which is fundamental for the professional practice of teachers, but it is complemented by how to teach, didactics, teaching strategies, which allow consolidation with students not only the content itself, this domain considers the teaching and learning process, the subject to be taught with those hows that will allow its teaching and learning.

This domain is subdivided into three subdomains that make it more specific: Knowledge of Features of Learning History (KFLH), Knowledge of History Teaching (KHT) and Knowledge of History Learning Standards (KHLS).

Knowledge of Features of History Learning Standards (KFLH)

In previous paragraphs, in the subdomain of the specific practices for the construction of historical knowledge that are specific to the specialised knowledge of the history teacher, the condition of the difficulties that students may present in their learning process in history subjects was visualised. This situation and the consideration of the didactic knowledge of the historical content, leads us to specify a subdomain that addresses the learning characteristics that can be taken up for the development of historical content.

According to (Climent, *et al*., 2014) this subdomain does not seek to establish the preponderance of the learner in a psychologistic stance, in which the learner is at the centre of the teaching-learning process; rather, what is sought and which is the stance that is contemplated in the present work, is to observe the learning characteristics of students in interaction with historical content.

At the same time, it is understood that there are very important positions on learning characteristics, both for the case of history and from more generalist perspectives, such as constructivism, cognitive scaffolding, meaningful learning and socio-constructivism.

In this respect, it is established that for the HTSK model, what is observed is the manifestation of the knowledge that the teacher who teaches history puts into play on his knowledge of the learning characteristics of his students, therefore, the clarification of a position not centred on the student, but which does consider him within the model, given that these characteristics form part of the specialised knowledge specified by the teacher in his professional activity.

Get started with background knowledge exploration

- Record of student opinions on the following questions

What is a revolution?

When, where and how is this event commemorated?

What characters are involved in the Mexican revolution?

Why do you think this process of revolution occurred?

Figure 3 Prior knowledge in pupil learning

In the above evidence, which is derived from the lesson plan that has been analysed, we can observe the knowledge that the teacher demonstrates about the learning characteristics that students present in the subject of history. This assertion is made concrete in the evidence, considering prior knowledge as a fundamental didactic assessment and as a starting point in the construction of historical content. Subsequent work will go deeper and look for categories that may form part of this sub-domain, for the time being, this sub-domain is confirmed as part of the HTSK.

Knowledge of History Teaching (KHT)

This subdomain, like the previous one (Climent, *et al*., 2014) also talks about knowledge intrinsically related to historical content. So it does not try to analyse teaching theories, but rather, to observe the manifestation of teaching theories that the teacher assumes at the moment of teaching their history classes.

Lacking at this stage the categories that would allow the subdomain to be specified, those teaching theories associated with the didactics of history that can be manifested in the HTSK are considered in a general way.

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An example for this purpose is the model of historical cognition developed by Peter Seixas in which, as mentioned in previous paragraphs, the concepts of first and second order are introduced in our country (Arteaga and Camargo, 2014) or the teaching theory of situated cognition that seeks to bring the student closer in situ to processes with which I had no direct contact and that through strategies such as the classroom museum, dramatisations, the making of models, allows the student to approach that content in a concrete way.

Knowledge of History Learning Standards (KHLS)

The last subdomain according to (Climent, *et al*., 2014, p. 84) is "the knowledge that a teacher has about what a student is stipulated to learn and the conceptual level at which he/she is expected to learn it at a given school moment" and although these same authors also assume that there are diverse positions in this regard, this situation is not different from the plurality of conceptual theoretical positions that have been addressed in the previous subdomains.

Thus, in the same way, in this sub-domain what is sought is to observe the manifestation of the HTSK demonstrated by the teacher, with respect to the learning standards he/she wants his/her students to achieve. These standards may be attached to the curriculum of a national curriculum such as the current 2022 Curriculum for primary education, but may also consider learning standards subject to international stipulations such as OECD.

Regarding this sub-domain in Mexico, the specificity on the teaching of history, with the evidence under consideration, takes into account its curricular location according to the school grade of primary education, its location of the general topics dealt with in teaching blocks, the levels of achievement to be reached through the learning objectives, the competences to be favoured and the expected learning, finally, the topic to be developed during the class session is written.

SUBJECT	History
BLOCK III	From the Porfiriato to the Mexican Revolution
PURPOSES	• Temporarily and spatially locate the most important processes in Mexico to consolidate the Republic • Assess the elements that have shaped the democratic life and the sovereignty of our nation
COMPETENCES	• Understanding of historical time and space • Management of historical information • Formation of a historical conscience for coexistence
EXPECTED LEARNING	It recognizes the causes of the Mexican Revolution, the moments of the development of the armed struggle and the proposals of the revolutionary leaders.
CONTENTS/THEME	The Mexican Revolution: Maderismo and the beginning of the Mexican Revolution. The development of the armed movement and the proposals of revolutionary leaders: Zapata, Villa, Carranza and Obregón.

Table 3 Curriculum structure in history teaching

Finally, the HTSK is proposed as a model that allows us to visualise the specialised knowledge of the history teacher and that at the same time can be taken as a backbone in the construction of teaching tasks for the training of primary school teachers who in their professional practice develop history classes. To conclude this argumentative work, the model is presented in an outline which makes it easier to understand in general.

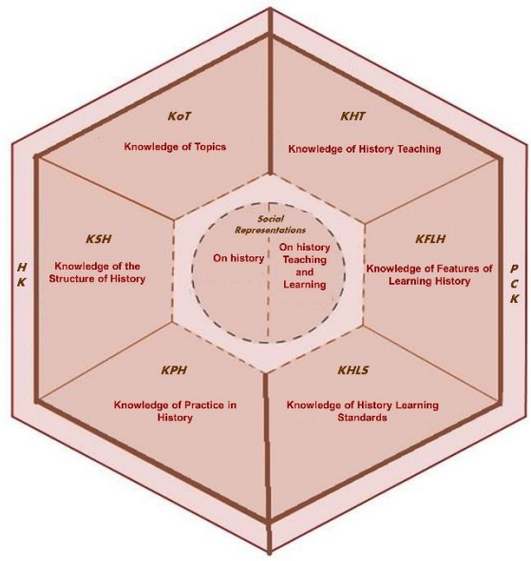

Figure 4 History Teacher's Specialised Knowledge (HTSK)
Own elaboration, based on the MTSK (Carrillo, Climent, Conteras, & Muñoz-Catalán, 2013)

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Gamification as a strategy for learning concepts meaningfully

La gamificación como estrategia para aprender conceptos significativamente

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Abstract

Learning concepts requires strategies that allow significant learning so that the said concept remains in the student's long-term memory. For this reason, strategies that avoid rote learning and promote the apprehension of concepts through the graphic representation of knowledge are necessary. This study pretends to identify if the gamification strategy through the GoConqr application enables learning concepts in Biology at the high school level. Methodologically, the analysis was from a quantitative perspective in a focus group. For this, a treatment, diagnostic, and post-treatment took place to know the plausibility of the gamification strategy and the GoConqr application. The results show the viability of the application for learning concepts, strengthening the understanding of the concept definition with motivational elements and significant activities. Other features that stand out are the immediate feedback provided by the application, which reinforces the collaborative learning process by promoting active participation. In conclusion, the research contributes to an active learning methodology for teaching innovation.

Gamification, Learning of concepts, Learning strategies

Resumen

El aprendizaje de conceptos requiere de estrategias que permitan un aprendizaje significativo de manera tal que el concepto se quede en la memoria de largo plazo del estudiante. Por ello es necesario utilizar estrategias que eviten un aprendizaje memorístico y promuevan la aprehensión de conceptos a través de la representación gráfica del conocimiento. El objetivo de la presente investigación se centra en conocer si la estrategia de gamificación a través de la aplicación GoConqr posibilita el aprendizaje de conceptos en la materia de biología en el nivel medio superior. Metodológicamente, el estudio se analizó desde la perspectiva cuantitativa a partir de un grupo focal. Para ello se aplicó un diagnóstico tratamiento y postratamiento con la finalidad de conocer la plausibilidad de la estrategia de calificación y la aplicación GoConqr. Los resultados muestran la viabilidad de la aplicación para el aprendizaje de conceptos fortaleciendo la comprensión de concepto-definición con tintes motivacionales y actividades significativas. Otros aspectos que destacan son la retroalimentación inmediata que proporciona la aplicación, lo cual refuerza el proceso de aprendizaje colaborativo promoviendo una participación activa. En conclusión, la investigación contribuye a metodología activa de aprendizaje para la innovación de la enseñanza.

Gamificación, Aprendizaje de conceptos, Estrategias de aprendizaje

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Introduction

Today, the educational process demands active methodologies and strategies that promote significant learning where students use said knowledge to solve problems in their immediate environment. In this sense, strategies to encourage reflection and understanding of what they learn are essential to avoid repetition and memorization of concepts, definitions, or topics since the intention is not to remember something in the short-term memory but rather to use previous knowledge to understand the new ones and thus contribute to the process of assimilation and accommodation, construction and deconstruction of knowledge.

It is also crucial to create good practices embedded in personalized environments and focused on didactic sequences that offer an innovative and attractive way of learning. In this sense, gamification represents an ad hoc means for the appropriation of concepts because through games (goals and challenges), students compete and learn without this process being tedious or representing an effort or unpleasant experience.

Taking this context into account, the objective of this research is to know if the GoConqr application promotes the learning of basic concepts of Biology in a virtual environment, as well as to identify if the gamification strategy contributes to said learning.

Theoretical Framework

This section describes fundamental concepts to understand the research theoretically.

Gamification

Gamification has its origins in business and company environments, and its objective is to persuade executives to invest in positive aspects of gamification (Llagostera, 2012). That is why it is considered a strategy since it deals with emotions and motivation. Regarding the educational field, this strategy gained importance, especially in recent years when the educational system moved to a virtual modality due to a global contingency.

Furthermore, gamification focuses on strategies, dynamics, and rules corresponding to the game (Werbach, 2012) as part of an active methodology. It makes clear that gamification is not a simple game but learning through ludic by establishing a close relationship with thought, identifying students' skills and abilities (Zichermann and Cunningham, 2011) to characterize their learning dynamics, and thus, designing ad hoc activities for meaningful learning.

It is also an innovation since it breaks the traditional classroom schemes, sparking curiosity and interest in the virtual context and encouraging participation and collaborative learning.

It is worth considering that gamification by itself does not foster meaningful learning. In this process, the two main actors of the curriculum are the students and the teacher. On the one hand, students are the principal entities of the process, who learn theoretical concepts through ludic in a pleasant way, avoiding tedious processes, demotivating experiences, or traditional tasks (Zepeda *et al*., 2016).

On the other hand, the teacher is the agent in charge of designing and implementing creative activities that encourage critical and reflective thinking in the student as a means of understanding new knowledge. At this point, gamification regains importance since it allows the teacher to embed thematic content innovatively (Orejudo, 2019), different from the traditional classroom. That is, in a flexible, pleasant, and significant environment for the student.

Finally, the following elements are necessary to gamify an activity: identification of objectives and delimitation of competencies to develop, the behavior of students and teachers, categorization of players, design of cycles with pleasant gamified learning experiences, and appropriate tools (Werbach and Hunter, 2012).

Implementing gamification

There are three essential elements in the implementation of the gamification strategy, which are: dynamic, technical, and mechanical. The dynamic copes with motivation, explaining the student's behavior, needs, and concerns.

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Therefore, it is closely related to mechanics. Among the most common dynamics are competition and achievement. The technique is related to project-based learning, and its purpose is to develop skills for a natural and immediate context, avoiding traditional and rote learning. In a gamified system, techniques are badges, classifications, or points (Marczewski, 2013; Werbach and Hunter, 2014).

Finally, the mechanics guide students' behavior through the rules that define the game, triggering impressions, challenges, and achievements (Martínez *et al*., 2013). The most common game mechanics are the following:

Points. It is the allocation of quantitative values (points) in response to performance or behavior.

Reward. It refers to the items a player receives as a reward for his behavior or actions during the game.

Challenges. It deals with the accomplishment of authentic tasks with instructional purposes based on a set of questions about a topic. Their results will provide the teacher with information about the consolidation of concepts.

Levels. Leveling up and getting to the highest level in the gamified system is a motivating factor for players, which shows their experience and achievements.

Rewards. It is obtained by achieving the objectives and overcoming the challenges proposed by the ludic activity.

Feedback. As a result of participation, the player receives motivation.

Methodology

The analysis of this study was from a quantitative perspective (Sampieri *et al.,* 2010), specifically through an experimental design where there was a focus group to which a diagnostic, treatment, and post-treatment were applied to know if the gamification strategy through the GoConqr application allows the appropriation of basic concepts in Biology 1 when using the memory game.

Sample

The research took place at the Enrique Cabrera Barroso Regional High School of the Benemerita Universidad Autonoma de Puebla, specifically in a focus group of 60 students enrolled in Biology 1.

The sample shares common characteristics such as problems in learning basic biology concepts, which favor rote and short-term learning and taking the same number of theory-practice hours.

Instruments

A standardized exam took place in the diagnostic and post-treatment phases. Said exam contains 50 items that measure basic concepts of Biology. Regarding the treatment, it consisted of a tecno-pedagogical model housed in the Moodle platform containing the gamification strategy as the principal means for appropriation of knowledge using the GoConqr application, specifically the memorama version where through the game, students individually, in pairs or teams apprehend definitions and concepts meaningfully.

Data collection

A standardized test was applied in the diagnostic and post-treatment phases to collect information about the phenomenon of study and know the plausibility of the GoConqr tool for learning biology concepts.

The treatment, which lasted five months, was embedded in the institutional Moodle platform and consisted of five learning sequences with digital activities based on a personalized study environment using GoConqr flashcards, where students could create their designs and share them with their peers.

Analysis model

The analysis model has the following two variables:

Variables of study

	Variable	Purpose
RQ1.	Does the GoCongr tool allow learning concepts in Biology?	Identify if GoConqr encourages learning concepts meaningfully, avoiding memorization
RQ2.	Does gamification foster conceptual learning?	Know if gamification develops learning concepts

Table 1 Analysis model
Source: Own Elaboration

Findings

The following lines describe the outcomes according to three sections: diagnostic, treatment, and post-treatment, which answer the two research questions of the study.

Diagnostic phase

The table below shows the appropriation of concepts before applying the proposal to learn them meaningfully in a virtual and personalized environment.

Students	Grade
1	10
1	9.8
1	9.6
1	9.5
1	9.4
1	9.2
1	9.1
2	9
1	8.6
3	8.5
2	8.3
2	8.2
3	8.1
3	7.9
4	7.6
3	7.5
2	7.3
5	7.1
2	7
3	6.8
5	6.7
3	6.6
2	6.4
2	6.3
5	6.2
1	6.1

Table 2 Results of the Diagnostic phase
Source: Own Elaboration

As seen in the table, 21 students registered grades lower than seven, while 19 maintained an average of less than eight, eleven less than nine, eight in 9 to 9.8, and one with an average of ten.

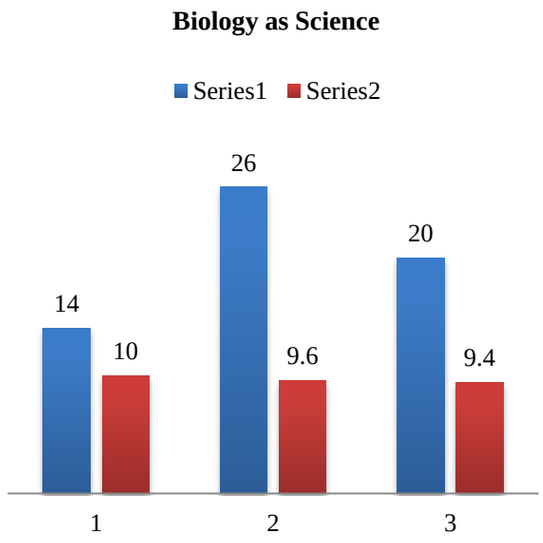
However, a high percentage of the focus group obtained unsatisfactory grades, which shows the need to identify a teaching strategy or methodology that allows students to learn concepts in a meaningful way in a personalized environment according to their needs and flexibility.

Another crucial aspect identified in this phase is the tendency to learn by rote since, in some items, the definition was not textual, causing the students to make mistakes when matching the explanation with the term. It suggests that their conceptual learning is mechanistic based on repetition and stored in short-term memory, which prevents meaningful learning (comprehensive memorization) based on understanding and reflection.

Treatment

The treatment consisted of five sequences focused on learning basic concepts like biology as a science, cell, cell division, human anatomy, and human physiology. The following graphs present the results of each group.

Sequence 1



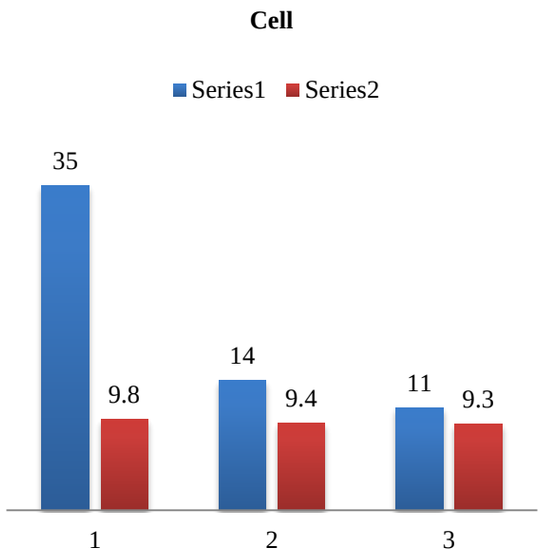
Graphic 1 Concepts related to Biology as Science
Source: Own Elaboration

The first sequence consisted of 10 memory activities in which 14 students showed 100% appropriation of knowledge related to biology as a science, getting 10. Meanwhile, 26 students obtained 9.6 and 20 students 9.4.

In general, the findings show a satisfactory appropriation of knowledge which coincide with the study by Lázaro confirming that gamification is an ideal means for meaningful learning (2019), as it is a personalized space adjusted to their learning styles where they learn at their own pace having the possibility to review the same content as many times as needed. They can also work on more complicated activities or exercises according to their level of proficiency in terms of conceptual baggage.

Moreover, thanks to the design section, they could do their flashcards to reinforce concepts or topics, which turns into a potential tool to learn, design their remedial work and evaluate their learning process.

Sequence 2



Graphic 2 Concepts related to the cell
Source: Own Elaboration

In the case of sequence two, the students carried out ten activities in pairs to learn concepts related to the cell, a fundamental component of the biology program.

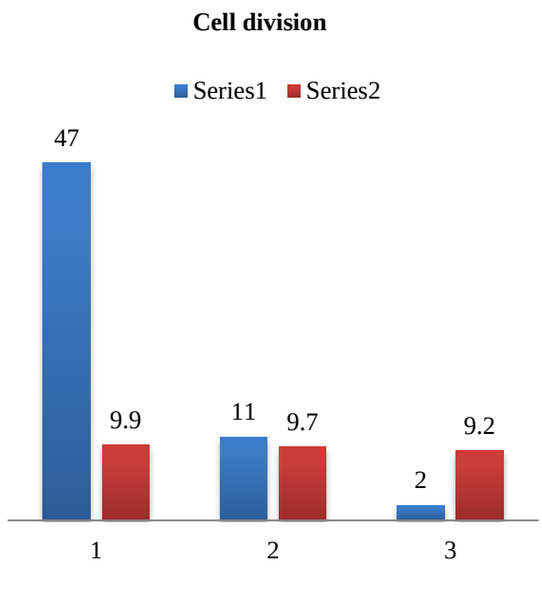
The results show that more than half of the focus group (35 students) obtained very satisfactory grades (9.8), followed by 14 students with an average of 9.4 and 11 with 9.3, respectively.

In this phase, gamification motivated students to learn and unlearn collaboratively (Lee and Hammer, 2011; Kapp, 2012, engaging them in such a process (Hamari *et al*., 2014).

In addition, it allowed active participation by all members, which led to a commitment and motivation to learn (Reiners y Wood, 2015). Last but not least, the students showed confidence and self-assurance during the construction of knowledge, which contributed positively to obtaining their grades and, therefore, to the appropriation of new concepts.

In addition, these results coincide with studies (Flores-González, 2020; Flores-González, 2022), which indicated that technology-mediated learning supports students by providing an environment of confidence through multimedia material that turns into a meaningful game (Area *et al*., 2015), an ideal way for learning.

Sequence 3



Graphic 3 Concepts related to cell division
Source: Own Elaboration

Regarding the third graph, referring to cell division, most of the sample obtained highly satisfactory grades (47 students, 9.9, 11 with 9.7, and 2 with 9.2). These outcomes show the viability of the GoConqr application as a gamification strategy for the learning process in virtual environments, where the main objective is to participate actively, share information, and above all, have fun while learning (Llorens-Largo *et al*., 2016), in this case, new concepts.

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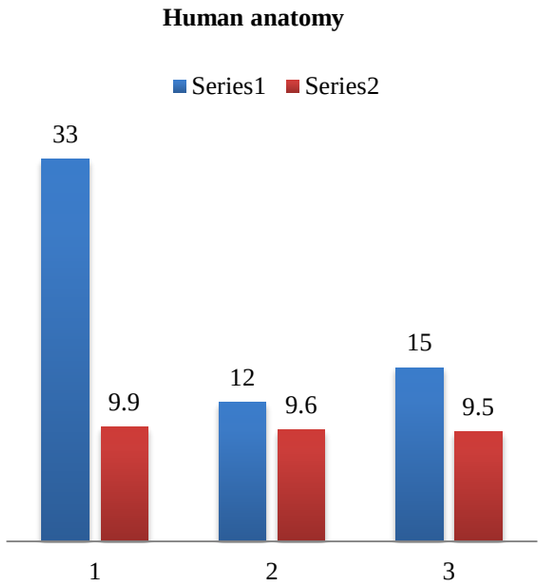
Besides, an essential characteristic of the gamification strategy observed in this phase was the commitment to participate in the knowledge construction process to achieve the learning objectives pleasantly and innovatively, reflected in their scores (O'Donovan *et al*., 2013).

Sequence 4

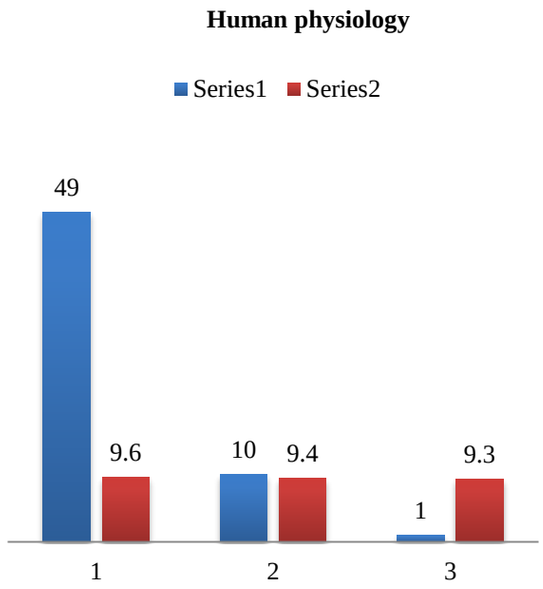


Graphic 4 Concepts related to Human Anatomy
Source: Own Elaboration

Once again, the graph shows that the GoConqr application with gamification potentiates the learning process positively. Indeed, its impact is evident in the scores obtained by the focus group, which are generally satisfactory (9.9, 9.6, and 9.5) and show a significant process stored in long-term memory. This phase also presented a fundamental component of gamification: competitiveness (Villagrasa *et al*., 2014), supported by the immediate and dynamic feedback of the application (Del Pinto, 2015).

Furthermore, this pairing made it possible to self-evaluate the learning process by creating extra material (Remedial work) according to students' needs to improve their experience in enriching their conceptual baggage.

Sequence 5



Graphic 5 Concepts related to human physiology
Source: Own Elaboration

As shown in the graphic, students registered high marks regarding their knowledge of the topic above (9.6, 9.4, and 9.3). These results confirm the gamification strategy as a potential instructional tool (Gallego *et al*., 2014) supported by the GoConqr application for understanding concepts, indicating that the inclusion of ICT in education is highly recommendable, as stated by Karam *et al* (2013). Moreover, in this phase, two particular characteristics of gamification took place: students' commitment to learning and competitiveness during the procedure.

Additionally, there was an innovative gamified practice during the ten proposed tasks where, through simulation, students did everything possible to meet the objectives of each activity, contributing to the enrichment of their conceptual baggage and problem-solving in their immediate context (Muntean, 2011).

Post-treatment phase

After the treatment, the standardized test of the diagnostic phase took place to know the effect of using the gamification strategy and the memory game based on the GoConqr application for learning biology concepts. The following table shows the results obtained.

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Students	Grade
10	10
11	9.9
5	9.8
3	9.7
3	9.6
4	9.5
5	9.4
2	9.3
3	9.2
3	9.1
2	9
1	8.8
1	8.7
1	8.6
1	8.5
1	8.4
1	8.3
1	8.2
1	8.1
1	8

Table 3 Results of the post-treatment phase
Source: Own Elaboration

The results show satisfactory conceptual change compared to the diagnostic phase. In this stage, nine students obtained an average of less than 9, 41 less than 10, and 10 with an average of 10, respectively.

These grades suggest that gamification is a strategy that promotes an active methodology for meaningful learning through experiences that lead to the practice of cognitive skills to develop specific competencies.

Therefore, gamification is not a distraction. On the contrary, it is a playful dynamic that favors students' autonomous learning, avoiding memorization or repetition of concepts, which privileges the high proficiency of conceptual baggage of the subjects under study.

In addition, the techniques and elements used in the design of the treatment allowed significant learning that goes beyond a simple game (Zichermann and Cunningham, 2011), dealing with decision-making (Stokel-Walker, 2015), increasing student's motivation and impacting positively on their academic performance (Fonseca *et al*., 2016). A crucial aspect observed in this stage was the change in the subjects' behavior when answering the exam, showing self-confidence when facing each question. They did not show nervousness, uncertainty, or doubt as in the diagnostic phase.

Said behavior is because of the significant learning accomplished during the diagnostic phase, which made it possible to answer the exam correctly, showing a broad understanding of concepts without confusion, although the exam did not contain textual definitions.

Conclusions

Based on the results analyzed in the previous section, it is concluded that the GoConqr application fosters significant learning of concepts through the gamification strategy because it establishes students' commitment to achieving acceptable academic performance through the dynamic and innovative implementation of the game between students and teacher-student.

Moreover, such a tool and strategy promoted fundamental elements for meaningful learning in a virtual environment. These are commitment, motivation, active participation, a personalized learning environment according to students' learning styles, competitiveness, and confidence.

Finally, all the previous characteristics outlined an active methodology that enables the appropriation of concepts in an innovative way and in line with students skills of this century who are digital natives.

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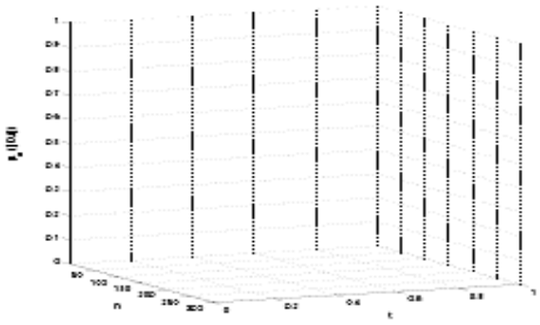

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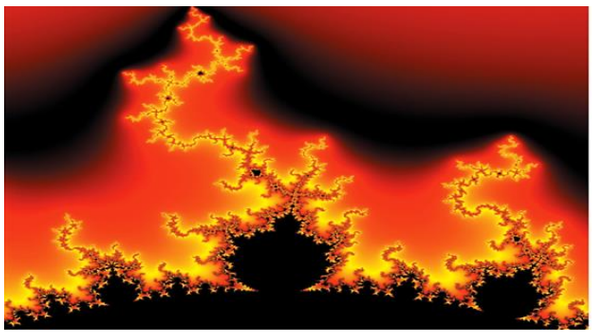

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