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MOBILE LEARNING METHODOLOGY (M-LEARNING) FOR PROFESSIONAL TRAINING OF ENTREPRENEURSHIP COMPETENCE IN UNIVERSITY STUDENTS

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Abstract

In a current challenge for universities is to train entrepreneurial students, capable of improving the positioning of companies nationally and abroad. Hence, this article has proposed to propose a mobile learning methodology (m-Learning) for the formation of professional entrepreneurship competence in university students that combines face-to-face and virtual learning modality. An investigation was carried out with a mixed cutting approach. transversal, through the use of documentary analysis methods for the characterization of the theoretical framework and the state of the art, the systemic for the elaboration of the methodology, the observation of the performance of university students, the pedagogical pre-experiment and the test Chi-Square hypothesis (X^2), for its validation, the results obtained were**:** A methodology is provided mobile learning (m-Learning) for the formation of professional entrepreneurship competence in university students. Favorable results are shown in the university student sample selected as entrepreneurs. The validated proposal allowed us to corroborate that, to form the professional competence of entrepreneurship in university students at the present time, it requires the establishment of a mobile learning methodology (m-Learning) based on entrepreneurship projects assisted by the use of mobile devices, which they integrate the academy with labor practice and the work of scientific and technological innovation. It can be applied in university careers at a national and foreign level with the pertinent adaptations and adjustments.

Keywords: professional competence, mobile learning, university student.

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Introduction

In the current era (post-pandemic) Higher Education has not always managed to raise the quality of university professionals to face the scientific and technological advances that are continuously generated as a result of changes in the ways and styles of teaching and learning professional skills in the university student body caused by Covid 19 based on the use of virtual and distance education, in this sense, Calle, Torres and Tusa (2021), as well as Macià and Garreta (2018) have drawn attention to the need for digital literacy.

The arrival of the pandemic imposed new challenges on the university. Now it was about developing the training process without the assistance of students and teachers at the *campus*. With this, the use of distance education and digital resources became the only possible alternative. This change places the personal components of the process before a new communication vehicle Montejo, Montejo and Montejo (2022), (p. 387).

At the University of Holguín, Cuba, as well as in the rest of the universities worldwide, teaching-learning modalities are used to train professional skills in students based on virtual and distance education.

Currently, mobile learning software developers (m-Learning) make available to teachers, students and other agents involved in the teaching-learning process of university students, applications on various topics so that they can be used as support in the learning process, whether from the modality of virtual, face-to-face or distance education, an aspect that requires the need to signify the teaching-learning methodologies to form professional skills in university students.

Currently, universities advocate the management of training processes of professional skills of their students who are innovative and entrepreneurial, given the responsibility in the training of professionals who will work in organizations and companies that consider entrepreneurship as an important part of the production or service process.

The foregoing specifies the need to form entrepreneurship competence in university students, as a quality that they must demonstrate during the performance of their professional and productive activity or services, which allows them from the integrated management of information and knowledge, in addition to the application of these to innovation processes, generate competitive advantages for organizations where they work professionally once they graduate in the post-pandemic era.

Direct observation in the field of Mechanical Engineering students from the University of Holguín during their performances as entrepreneurs in labor practices allowed the identification of a problematic situation referred to the insufficiency that they present in the formation of entrepreneurship competence, due to the following causes:

In the identification of needs and opportunities to take into consideration during the machining processes of parts, for the added value generated by the work carried out, created or improved, in the management of financial resources necessary for the company to improve its efficiency, quality and economic profitability, they do not always assume risks during the machining processes of parts, in the personal effort, decision and perseverance to face the challenges imposed by the production processes associated with mechanical engineering.

The indicates that it is necessary to use ways and forms of mobile learning (m-Learning) to train professional entrepreneurship competence in university students.

The analysis of the state of the art related to the previous approach, recognizes the existence of various national and international studies, among which are

cited: Agustín, Torres, Angulo and Martínez (2017),Cabero, Fernández, and Marín (2017), Vialart and Medina (2018),Díaz, Almerich, Suárez and Orellana (2020), Juca, Carrión and Juca (2020), Machado and Montes de Oca (2020), Alonso, Moya, Vera, Corral, Bazurto and Avila (2020), Albert and Lopez (2020),Rodrigo, From-Houses and Water (2020), Moll (2021), Herrera (2021), Alonso, Cruz and Aguilar (2022),Nápoles, Sobrino and Rodríguez (2022), as well as Gutiérrez, Montero, Espitia and Torres (2023).

In these investigations, the existence of models, strategies, premises, conceptions of mobile learning (m-Learning) for the training of university students and professional skills can be appreciated, however, due to the objectives they have pursued, the absence of the way, the way to follow to form the professional competence of entrepreneurship based on the use of mobile learning (m-Learning).

That is why it was pertinent to investigate the following problem: how to use mobile learning (m-Learning) for the formation of entrepreneurship competence in university students?

The objective of the work is: Propose a mobile learning methodology (m-Learning) for the formation of entrepreneurship competence in university students.

Materials and methods

A cross-sectional and pre-experimental observational mixed investigation was carried out according to Hernández, Fernández and Baptista (2014), and this research approach, starts from the idea of the problem and approach, visualizing the scope of the mobile learning methodology (m-Learning) for the formation of entrepreneurship competence in university students as a scientific result that is contributed in the research, elaboration of the hypothesis and determination of the variables and development of the research design.

The research is based on the following hypothesis: the formation of entrepreneurship competence in university students in post-pandemic times is improved, if a mobile learning methodology (m-Learning) is applied, based on the design, development, and evaluation of projects. of entrepreneurs that make up the academic (teaching), labor (insertion in labor entities), research and extension component by taking advantage of the potential of mobile devices.

In this hypothetical approach, the dependent variable refers to the formation of entrepreneurial skills in university students and the independent variable refers to the mobile learning methodology (m-Learning).Of the scientific methods assumed in this research, the document review method based on the collection, study and extraction of scientific knowledge from the national and foreign literature associated with mobile learning (m-Learning) and on the formation of the competence of entrepreneurship. The observation of the students' actions was also used to verify the state of the formation of the entrepreneurial competence supported by the use of mobile devices, as well as the systemic to develop the methodology.

The pre-experimental design with a cross section was used to validate the methodology provided by the investigative study accompanied by the Chi-Square statistic (X^2) according to criteria of Hernandez, Fernandez and Baptista (2014) to accept or reject the research hypothesis and therefore the significant transformations achieved in university students in the formation of entrepreneurship competence and its effects on productivity and work performance of production and service entities. . The target population of the case study carried out to validate the methodology was made up of 200 Mechanical Engineering students from the University of Holguin. Through a simple random sampling by statistical recommendation (Hernández, Fernández

and Baptista, 2014) a sample of 60 students was selected, which represents 30.0% and makes it representative of the volume of the population.

Analysis and discussion of results

Theoretical framework that supports mobile learning (m-Learning) for the formation of entrepreneurship competence in university students.

The virtualization of higher education not only implies the technological support of its processes, but it goes much further; Its essential objective leads to transform the disciplines, the role of the teacher, the student, and the educational institution itself, although it is not the technologies that vary the processes, but the way in which they are used for the sake of a transformative, flexible result. and focused on students, which demands changes in the mentality and practices of the teaching staff towards a new formation Nápoles, Sobrino and Rodríguez (2022) (p. 570).

Calle, Torres and Tusa (2022) state that "society is digitally literate is one of the development objectives in the 21st century, because it is currently necessary to acquire real skills to be able to self-manage knowledge in an informational context" (p.100)

The use of mobile technology in learning environments is known as mobile learning or more commonly as m-Learning, for several years now research exercises have been carried out in this regard, in the case of Latin America there are many investigations that have been carried out. in the last decades, one of the first studies that we can find regarding the subject where an investigation is carried out in a postgraduate program started in 2007, in this study important results were reached that undoubtedly mark an important line of research for the region. Mobile devices are considered an additional resource to support the teaching-learning processes in the virtual environment, where the aim is for the student to remain the main builder of their knowledge, and mobile devices are an additional resource to those offered by their virtual environment Herrera (2021). (p. 102).

Systematizing the criteria of Rossi and Barajas (2018), Sánchez, Sánchez and Ruiz (2018), as well as Vialart and Medina (2018), one agrees in recognizing that the constant progress that mobile technology has is, without a doubt, a invitation for university teachers from scientific-methodological work to implement mobile learning methods as a way to contribute to the formation of professional skills.

It is recognized that in mobile learning (m-Learning) the learner is not in a fixed, predetermined location; or learning that occurs when the student takes advantage of the opportunity offered by learning through mobile technologies, is a combination of e-learning and mobile computing that mixes mobile and wireless technology to provide learning experiences combining it with face-to-face learning styles.

Se interprets that mobile learning (m-Learning) is the process of appropriation of contents associated with the object of work of a profession, specialty, occupation and trade that the student achieves, supported by the use of mobile devices: Tablets, cell phones, laptops , among others in an autonomous, creative way or in teamwork, which allows its application in the solution of professional problems, based on the meanings, senses and professional experiences that it is acquiring based on the interactivity with the mobile technology that it uses. during the training of professional skills in the academic, labor, investigative and extension component.

The educational potential of each student's mobile devices should be used to favor the interactive appropriation of the content of the profession they learn during the academic component and its application in solving professional problems during work practice in companies and thereby contribute to form entrepreneurship competence through the design,

development, and evaluation of projects.

The project in the context of mobile learning is interpreted as the form of organization of the teaching-learning process in which the transmission and appropriation of the content of the profession is produced, supported using mobile devices as means that combine face-to-face and virtual modalities based on the link between teaching and education. labor insertion (education at work) and research, based on the performance of professional tasks in a defined space-time relationship with the help of material and human resources, aimed at achieving the professional training of university students.

Through the interactivity that occurs between the student with the teacher, the tutor and other agents that intervene in the process of training the entrepreneurial competence with the use of mobile devices, the methods used are signified in a way that combines virtual learning with face-to-face learning based on the use of projects as a form of organization that integrates the university academy with work practice (education at work) and research.

Recent developments in mobile technology have spawned a new range of touchscreen digital learning tools, with a wide range of applications, which has meant that many schools see them as a viable option to equip their students with a learning resource that meets the demands of the present times. (Rodrigo, De-Casas and Aguaded, 2020, p.63)

That is why mobile learning (m-Learning) constitutes an approach that in the current era contributes to forming entrepreneurship competence in university students.

In this sense, Machado and Montes de Oca (2020) affirm that "undoubtedly, talking about competencies is talking about lifelong education and self-education, comprehensive training, everything that constitutes a challenge for pedagogical research both at a conceptual level, curricular as didactic" (p. 408)

For Martínez, Padilla and Suárez (2019) "entrepreneurship is understood as a process that begins with the generation of an idea and continues with its implementation and its launch on the market." (p.130) To achieve the above, the entrepreneurial competence must be developed in the student, which allows them to access better opportunities for insertion in the world of work.

Systematizing the research of Alonso, et. to the. (2020) entrepreneurship competence is a quality that the student possesses in which he expresses the integration of knowledge associated with leadership, teamwork, creativity and innovation that are linked and articulated with the basic and specific knowledge of the profession to the generation of innovative alternative solutions to professional problems that contribute to improving the positioning of a company at a local, national and foreign level, which are mobilized through the versatility of their professional performance during the solution of professional problems and deployment of their professional mobility, whether geographical or functional.

Forming such competence allows students to develop entrepreneurial projects that generate innovations of an economic nature, oriented towards sustainable and scientific-technological development to achieve significant changes in production processes and services.

That is why the methodology that is provided in this research is presented below.

Methodology proposal

The methodology expresses a set of interrelated actions aimed at the formation of entrepreneurship competence in university students based on m-Learning and directed from the theoretical by the method provided by Alonso, et.al. (2020).

The novelty that is introduced to the method contributed by Alonso, et.al.

(2020), as well as the national and foreign literature consulted, lies precisely in the systematization of m-Learning as an approach to train entrepreneurship competence in university students.

The actions to be carried out are proposed:

Action 1. Design the profile of the entrepreneurial competence to be trained in university students.

Systematizing the research carried out by Alonso, et. to the. (2020), the student must achieve the following competence: Manage entrepreneurship projects to solve problems that arise during the production and service processes according to the work object of the profession, whose products are innovative in the company and contribute to the improvement of its position on a local, national and foreign scale, with creativity and innovation, professional autonomy, optimal use of human and material resources, research and information technology, leadership, teamwork, diligence and responsibility.

Action 2. Characterize the state of entrepreneurship competence demonstrated by university students.

For this, it is suggested to use observation guides to the performances as entrepreneurs, review of documents, interviews, questionnaires. The foregoing will allow determining, according to the entrepreneurship competence systematized in action 1, successes and failures, to conceive the mLearning learning actions aimed at their training from the conception of learning by working and working by learning.

Action 3. Characterize the diversity of mobile devices.

It should start from characterizing the diversity of mobile devices that students have, companies and in the workplace where they work, since m-Learning can make learning to form entrepreneurial competence possible in different time zones. and geographic locations in which they are located as part of their management functions. Within the diversity of mobile devices are, among others, the following: Pagers, pocket communicators, Internet Screen or Smartphones, car navigation systems, entertainment systems, television and Internet systems (WebTV), mobile phones, laptops, tablets, organizers and personal digital assistants.

The m-Learning can offer mechanisms to help the formation of the entrepreneurial competence such as surveys and text messages with exchange of opinions in real time, which allow students a more assertive communication to facilitate the formation of said competence from conception learning by working and working by learning.

Action 4. Socialize with students the state of preparation for the use of mobile devices as a means of training entrepreneurship skills.

It proceeds through a workshop at the beginning of the procedure to socialize with students about their skills for the use of mobile devices as a learning resource to form entrepreneurship skills, which will allow them from a differentiated diagnosis (action 2), to determine the ways more effective for the use of mobile devices owned by both staff and the job where they work, as a means of training their entrepreneurial skills.

Action 5. Design entrepreneurship projects based on the use of mobile devices.

The projects will have the following structure: Professional problem, entrepreneurship competence, system of learning tasks to be carried out based on the use of mobile devices, professional learning methods to be used based on m-Learning, indicators to evaluate the results.

It is recommended to design projects according to the singularity of tasks and functions that the student performs in the company according to his profession.

Action 6. Develop entrepreneurship projects based on m-Learning.

Mobile devices that are used as a means of learning entrepreneurship must consider the following elements: configurability, complexity, multi-focus, multimedia, reflection, reconstruction and interactivity, which stimulates the use of the mobile device as a learning medium. This condition is manifested in the degree of dependency of configurability, complexity, multi-focus, multimedia, reflection and the reconstruction of this characteristic, based on the relationship of the mobile device with the components of the teaching-learning process. : problem-objective-content-methods-means-forms and evaluation.

Table 1 shows the schedule of m-Learning learning tasks that the student will carry out to form the entrepreneurship competence.

The cycle shown is repeated from each professional problem identified and a process of professional training of entrepreneurship competence is established on a continuous basis. On the other hand, the application of projects as a form of m-Learning learning presupposes considering the use of problematic methods that take into account the following didactic requirements:

- The multimedia when referring to the different mobile devices that are used.
- The use of problematic approaches to learning with an active, proactive (interactive) character

Table 1. General schedule of tasks for the formation of the entrepreneurship competence based on m-Learning.

Topic	Entrepreneurship competence learning task	Modality (virtual or face-to-face)	educational resource	Time estimated
1	Identify problems that arise in the processes of production and services of the company	Taller	Chats WhatsApp y Telegram	8
2	Characterize the technological work methods for solving professional problems	specialized conference	WhatsApp y Telegram	14
3	Design innovative, entrepreneurial management projects to solve professional problems.	Taller	Chats, discussion forum Whatsapp y Telegram	22
4	Apply innovative, entrepreneurial management projects to solve professional problems	On-the-job training	forum-debate Whatsapp y Telegram	90
5	Evaluate the impacts achieved in the production and services of the company with the application of the projects	Taller	Chats Whatsapp y Telegram Questionnaire	16
	Total interactive hours			150 h

- The treatment of the relationships between the instructional with the educational and professional growth:

Professional learning methods with a collaborative and interactive approach that are used with mobile devices should be promoted, an instruction aimed at the appropriation of knowledge and development of professional skills (learning to know and to do) to, on that basis, stimulate a process of education of professional values (learning to be, to be and to coexist) in the student to learn to develop entrepreneurial projects from the management functions.

From the combination that occurs between the instructional and the educational, spaces and mobile devices will be promoted for self-evaluation and peer-evaluation of the professional growth that the student is achieving in the short, medium and long term, expressed in the learning results that they are achieving associated with the profile of the entrepreneurial competence.

- The reflexive to the extent that the mobile device allows the student to learn to develop entrepreneurial projects during the fulfillment of their functions from the conception of learning by working and working.
- The interactivity which is revealed through the assertive communication exchange system that is presented in the diversity of mobile devices that are used to promote the development of chats, discussion forums, learning activities, questionnaires, video conferences, among others through the business instant messaging service (Jabber), WhatsApp channel and Telegram.
- Favor the student-centered model.
- Support the construction of knowledge through mobile devices that make it possible to combine the instructional with the educational and the professional growth of the student.

Action 7. Control the development of entrepreneurship projects.

The control function is responsible for measuring, comparing, assessing, and recording the regularities during compliance by the company's students with what is planned in the development schedule of entrepreneurship projects based on m-Learning. autonomous integrator and in case of deviations take corrective actions.

As a consequence of these regularities in this action of evaluating (which is achieved through operational actions: measuring, comparing and finally assessing and recording) it could be reviewed how the executed entrepreneurship project manages to integrate m-Learning, that is, combine face-to-face and virtuality for the formation of entrepreneurship competence, based on the unity between the instructive, educational and professional growth nature of university students as entrepreneurs, and restructure it, based on the level of appropriation and application of knowledge associated with competition.

Action 8. Evaluate the state of the formation of the entrepreneurial competence.

For this, the following criteria must be taken into account: The authentic and impartial nature of the evaluative act of the formation of the entrepreneurship competence, treatment of the cognitive and affective complexity of the content from the needs and potentialities of each student, treatment of the meaning and professional sense, dialogical-reflexive interpretation in face-to-face and virtual socialization spaces during the evaluation act of the result of the entrepreneurship project, expected impacts on the entrepreneurship project aimed at solving the problem from an economic, technological, productive, service, and energy perspective , environmental and social, treatment of self-evaluation, co-evaluation and hetero-evaluation, as well as the effectiveness of the mobile devices used. Based on these criteria, qualitative and quantitative indicators must be drawn

to evaluate the result of the task, taking into account the measurement, control, assessment and self-assessment of the instructive, educational and resonance effects.

Validation of the methodology. Results obtained.

The methodology was applied through a pedagogical pre-experiment carried out in a sample of 60 Mechanical Engineering students from the University of Holguín, assuming 30.0% of the volume of the population by statistical recommendation, through simple random sampling.

Through direct observation in the field, the professional performance of the students was assessed, in which they demonstrated evidence of entrepreneurial competence, operationalized as follows:

Very good: when it meets the following indicators: 1. Identifies professional problems. 2. Design entrepreneurship projects with the use of mobile devices. 3. Develop entrepreneurship projects with the use of mobile devices. 4. Evaluate the impacts on entrepreneurship projects with the use of mobile devices. 5. Demonstrates leadership, creativity, innovation, daring, assumes risks and generates innovative alternative solutions to problems that contribute to improving the positioning of the company at a local, provincial, and national level.

Good: When it meets indicators 1, 2, 3 and 5 with slight difficulties in 4

Regular: when it meets indicators 1 and 2 and shows difficulties in the others

Deficient: when it does not reach the category of regular.

Table 2 shows the result Initial state of the entrepreneurship competence.

Table 2. Initial state of the entrepreneurial competence of Mechanical Engineering students before applying the methodology (January 2022)

Assessment	Amount	Percent (%)
Very Good (VG)	0	0.0
Good B)	10	17.0
Regular (R)	38	63.0
deficient (D)	12	20.0

It is shown that there are insufficiencies in the formation of the entrepreneurial competence of the students in the sample.

The methodology was applied during the period from January 2022 to December 2022, evidencing the following transformations that attest to its novelty: Incorporation into the entrepreneurship competence professional model, as well as the mobile learning methodology for their training.

Through direct observation in the field, the professional performance of the students was evaluated again after applying the methodology. Table 3 shows the result obtained.

Table 3. Status of the formation of the entrepreneurship competence of Mechanical Engineering students (December 2022) (after applying the methodology in a formative semester).

Assessment	Amount	Percent (%)
Very Good (VG)	25	41.6
Good B)	29	48.3
Regular (R)	6	10.1
deficient (D)	0	0.0

The graph of Figure 1 establishes the comparative data of the state of professional entrepreneurship competence before and after applying the methodology.

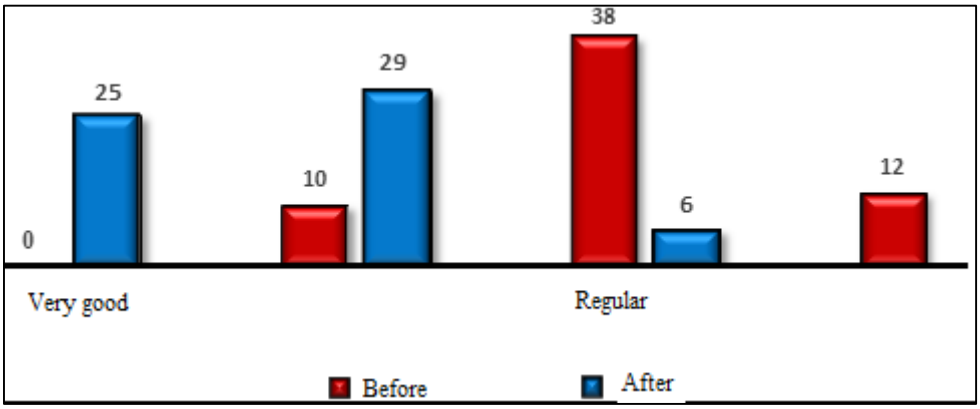

Figure 1. State of the formation of the entrepreneurship competence of Mechanical Engineering students before and after applying the methodology. Source: authors n=60

The graph shows that there are improvements in the formation of the entrepreneurial competence of the sample of students after applying the methodology.

The following condition was applied: If the value of the probability obtained (X^2) is less than the assumed degree of reliability (α), that is, it is true that: p (X^2) ≤ α, then H is accepted$_1$ and H is rejected$_O$. If the value of the probability obtained (X^2) is greater than the assumed degree of reliability (α), that is, it is true that: p (X^2) > α, then H is accepted and H is rejected$_1$. (Hernández, Fernández and Baptista, 2014)

When applying the statistical test with the use of Excel, a probabilistic value of p (X^2) = 0.00234, which is below the degree of reliability assumed to be 0.05, that is: p (X^2) = 0.002 < 0.05; so H is accepted$_1$ and H is rejected. This result demonstrated that the differences of the data obtained in the graph of figure 1 are significant**.,** that is, it is inferred that with the application of the methodology, a 95.0% reliability is achieved, significant improvements in the formation of the entrepreneurial competence of Mechanical Engineering students, an aspect that allows recognizing its validity.

As qualitative transformations achieved in the application of the methodology, the following could be verified: They improved in the identification of needs and opportunities that they took into consideration during the mechanical production of parts that they generated in the projects, they efficiently used research and teamwork that It allowed them to generate technological innovation alternatives for the solution of professional problems with greater autonomy and

professional creativity. They assumed risks during the deployment of their professional mobility and manifested greater personal effort, determination, and perseverance to face the challenges imposed by the implementation of the project. of entrepreneurship.

Conclusions

A mobile learning methodology (m-Learning) has been proposed for the training of entrepreneurship competence in university students based on projects that promotes the training of more entrepreneurial professionals during their business work activity and their treatment based on the integration between the teaching with the work practice and the research and technological innovation work that they carry out during their professional training process.

It is also possible to conclude by recognizing that the entrepreneurial competence is of a transversal type of the profile of professional competences that characterizes a university graduate, through which he expresses knowledge, skills and values from a humanistic approach, aimed at the generation of successful actions that allow you to improve and transform your work object.

The validity of the proposed methodology is tested by verifying its relevance and reliability, as a result of the significant differences achieved in the formation of the entrepreneurship competence in the Mechanical Engineering students of the University of Holguín who used it, which generated improvements in the productivity, performance of companies in the territory, and influenced the improvement of their positioning locally and nationally.

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