Academic Program for the Relationship with Companies: An M-Learning Strategy to Promote University-Business Collaborations

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***Abstract*—The interest in including mobile learning (m-learning) in training processes has grown considerably. In recent years, there is evidence of a progressive research production on the subject; especially in Latin America, it is seen as an alternative to bridge the educational gaps. In the context of higher education in Colombia, most university students work full-time and study at night, it makes it difficult for them to do internships and makes them feel vulnerable when taking on job positions associated with their profession. Our goal is to create a virtual internship laboratory supported by a mobile application developed specifically for this purpose. It combines Problem-Based Learning (PBL) with Action- and Decision-oriented Research (ADR). Through a descriptive qualitative study, a mobile application is designed and validated to promote the university-business relationship, it was named Academic Program for the Relationship with Companies (PARCE, i.e., Programa Académico de Relacionamiento con Empresas). The introduction contextualizes university education in Colombia and the receptivity of mobile learning, subsequently, the article describes the technical characteristics and qualities of the developed mobile application, as well as the methodology, approach, and data collection process. The information is analyzed by descriptive statistics categorized by dimensions to assess the impact of the mobile application on internship processes in a higher education institution. The academic performance was positively assessed with respect to the development of skills and professional abilities acquired and enhanced thanks to the flexibility of the mobile application and the PARCE program. Although it has been designed especially for internship processes, it is adaptable to different areas of knowledge and educational levels. The most recurrent rating of the program, on a scale from 1 to 5, by entrepreneurs was 4.82.**

***Keywords*—mobile learning, higher education, internship, university-business relationship**

I. Introduction

The Higher Education Information System (SNIES by its Spanish acronym) [1] presents a consolidated report indicating that, in Colombia, there were 2,355,603 people enrolled in higher education programs by 2020. It means, from a generalized view of the figures from the national census, that approximately 9.7% of the total population access higher education and evidences the educational gaps in the country.

The same study shows that 682,329 people attended programs under traditional distance and virtual education before the confinement due to COVID-19. These data are useful to recognize the impact of Information and Communication Technologies (ICT) in Colombian education because, by their nature, they represent lower costs for students (tuition costs, transportation, travel expenses, access to support material, among others). Therefore, in the face of socioeconomic complexities, ICT would democratize education [2], and inclusion in the educational processes would contribute to generate open and accessible learning environments that facilitate developing individual skills and the formation of human capital [3].

As part of the university training process, educational institutions must create the academic and administrative conditions necessary to do internships as an opportunity for students to relate the knowledge acquired from theory with praxis. This is considering that trainees or apprentices seek to learn about the profession and about themselves as professionals [4]. Therefore, the importance of fostering spaces where companies and students have a relationship. This also contributes to have indicators that evidence the social impact of the institution on its area of influence and the relevance of the academic program according to the profiles needed, expectations, and evaluations made by the companies receiving interns.

Internship integrates the student into a learning context located in real scenarios, and enables the acquisition of knowledge, skills, and competences necessary for the professional practice [5]. Hence, the internships that students carry out throughout their university studies are deeply rooted in current higher education systems [6].

Considering the importance of internships and the intention to generate efficient and attractive didactics adjusted to the characteristics of students, we explore the behaviors associated with connectivity in the networked society, and the way to include them in the training process. Higher education becomes a preferred field for the study of mobile learning (m-learning) [7].

Regarding the devices used to access the Internet, cell phones presented an exponential growth in the last ten years. This does not mean that coverage is universal, as some people may own more than one while others have none. However, the adoption of these devices is extremely high in all socioeconomic groups [8].

In Colombia, the use of smartphones is so prevalent that the National Administrative Department of Statistics (DANE by its Spanish acronym) [9] revealed in its Technical Bulletin of basic ICT at homes that the proportion of people aged 5 and older who used these devices to access the Internet was 84.9%. These figures show the rapid development of these technologies and the way they have permeated different areas

of daily life.

Education cannot be oblivious to this behavior, the current trend towards societies with greater access to knowledge implies new challenges and opportunities. Science is used as a fundamental input for the advancement and development of society [10]. Not surprisingly, access to mobile devices has been a concern for developing countries, as it is indispensable for economic, social, and educational dynamics. Colombia took an important step with Law 1819 of 2016, which eliminates the collection of taxes on the purchase of some smartphones [11].

In this context, it is necessary to design and validate an application to incorporate ICT through m-learning into the curricular activities of university students. For this, we used Problem-Based Learning (PBL) as a facilitator in the application of Action- and Decision-oriented Research (ADR) promoted by the Humboldt University of Berlin in the context of internships.

In this particular case, Corporación Universitaria de Sabaneta, located in Sabaneta—the smallest municipality in Colombia, which has approximately 870 companies registered with the Chamber of Commerce—is taken as an investigative context [12]. The virtual internship laboratory of the Faculty of Business and Business Sciences was created through the Academic Program for the Relationship with Companies (PARCE, i.e., Programa Académico de Relacionamiento con Empresas). It operates through a mobile application with the same name and seeks to improve student's training regarding practical skills and their preparation for the labor market, especially their interaction with companies and organizations. Currently, higher education faces the challenge of training students for an increasingly competitive and demanding work environment. In addition, students need to have practical skills and know how to use their knowledge in real situations.

In this study, it is hypothesized that a didactic strategy modeled for m-learning can positively impact the internship process. This hypothesis stems from the need to explore and evaluate the potential of mobile technologies applied to education and their interaction with the business environment. The objectives of the research are to explore the factors that favor PBL applied to the virtual internship laboratory, to develop a mobile application that allows all students of this educational institution to approach the productive sector, and to assess the virtual internship laboratory by applying research instruments to participating students and entrepreneurs.

II. Theoretical Framework

A. Importance of Internships

The relationship with the productive sector—conceived as the business-academy relationship—is based on higher education institutions through the exercise of internships. The latter allow students to use their knowledge and teachers to strengthen their administrative management via advice and training. This is because the university is the first step to define a professional path and must be complemented by the practical learning that a young person gets when facing a workplace [13]. Thus, promoting students' internships, along with teaching activity, contributes to the development of their skills and becomes a way of bringing students closer to the work context by applying the curricular flexibility criteria. In that training scenario, different from the classroom, they can demonstrate that they not only have the appropriate academic and technical knowledge, but they have also acquired professional skills, attitudes, and values that show their ability to face an increasingly competitive labor market [14].

Business internships offer students the opportunity to learn about the functioning of a company, having a comprehensive understanding of the business world, and developing a critical and reflective perspective on the economic and social reality of their context to develop proactive skills. It involves finding solutions to the needs and difficulties of the environment in which they live and where they will grow professionally [15].

The internship is not a simple approach to professional contexts so that students feel more motivated by their major, but a new way of facing their education by diversifying the scenarios, expanding the spectrum of training agents, and enriching the skills and meanings of the things they are learning [16].

In addition to the adaptability of the junior professional —recently graduated [17]—to work, internships contribute to strengthening the relationship between the university and the business sector; it allows them to establish collaborative and cooperative links. Companies can benefit from the energy and creativity of students, as well as their academic training, while students can gain valuable practical experience and make important professional contacts and networking under a collaborative dynamic [18]. One outstanding point of view is that current models of higher education propose that learning objectives are not only based on the acquisition of knowledge, but on the incorporation of competencies that support student's personal, civic, and professional performance [19].

This implies including methodological proposals in which student learning is action-oriented and activities have a direct relationship with the context that surrounds them [20]. This way, business sustainability [21] can generate the changes necessary to implement strategies for the creation of value based on knowledge and the way it is acquired in companies [22].

In summary, the internships carried out by university students represent a unique opportunity for the comprehensive training of future professionals, the consolidation of the relationship between the university and the business sector, and the contribution to the economic and social development of the country. The aim is to provide students with tools so that they can interact and make decisions in possible real situations in their professional life [23].

B. Academic Program for the Relationship with Companies (PARCE)

The Academic Program for the Relationship with Companies, PARCE, emerged as a result of a research proposal. "Parce" is an expression widely used in Colombia, especially in Antioquia (where the research is carried out). It is basically a shortening of parcero; a word that means "friend", "close companion". For this reason, it is taken as a basis to name the academic-business internship program

mediated by ICT, and its acronym is used in the logo of the mobile application (Fig. 1). A yellow butterfly is also included to honour the work of the only Colombian Nobel Prize in Literature: Gabriel García Márquez.

Fig. 1. PARCE logo.

Through PARCE, the virtual internship laboratory at Corporación Universitaria de Sabaneta was launched for the second academic period of the year (August–November 2022). One of the main advantages offered by a laboratory is interactivity, it allows the student to be in contact with a real project [24]; practical and laboratory classes in any subject also make possible to reinforce the knowledge shared in the theoretical classes by relating the theoretical concepts with the experience [25].

As a strategy to motivate the approach of companies to the university, we reached out to the Micro, Small and Medium-Sized Enterprises (MSME) sector of the South Aburrá Valley (main area of influence of Corporación Universitaria de Sabaneta) and some companies in Medellín, with the aim of knowing their current situation with respect to the administrative procedures innovation, accounting, internationalization, and IT management. Then, we identified possible interventions by implementing the PARCE program.

With the information obtained on the usability and experience with the software, and by incorporating some MSMEs into the PARCE program, the internship laboratory started in the 2022-2 academic period. The PARCE program begins with a number of companies that correspond to the number of students who were enrolled in the "Degree Option" (in the curriculum, it corresponds to the academic period in which the degree requirement must be met) and who opted for the internship modality, also fulfilling the requirement to work and study at the same time. PARCE starts operations with 29 companies, 29 students, and 4 advisors.

C. *Parce Specifications*

PARCE is developed on Android version 1.3.1 by Kotlin, which enables using a fully functional online application on Android. This application has developed many functions to provide a smooth experience to all users. Currently, it is cross-platform with 100% Android support [26] and has gained greatest popularity for developing Android applications [27].

We chose to develop a mobile application compatible with Android because a survey on mobile operating systems applied to students of the Faculty of Business and Business sciences showed that 87% use this one. Since its launch in 2008, Android has become the most popular operating system for smart mobile devices [28], however, the programming language allows a future adaptation to run it on devices with iOS.

The Front-end or visual interface of the PARCE mobile application was designed with the intention of always evoking Gabriel García Márquez and preserving the association with academic activities in a sober and conservative way [29]. The designs were created in Canvas, free version, and improved with Adobe Illustrator by the software developer to incorporate them into the application design (Fig. 2).

Fig. 2. Graphic representation of PARCE.

PARCE features the possibility of creating requirements (companies), interventions (students and teachers), generating email notifications each time one of these actions is taken, and after signing in.

Regarding the permissions that the user must give to the application, it requires approval to upload files. If the permissions are denied, the application will not work properly, since this functionality is necessary to create requirements or interventions that will be essentially evidenced through PDF files attached by the actors (companies, students, and teachers can upload documents).

To sign in in the PARCE application, IT requests only basic data, all fields being mandatory; it also requires the user to enter a password that must be at least 6 characters long (Fig. 3).

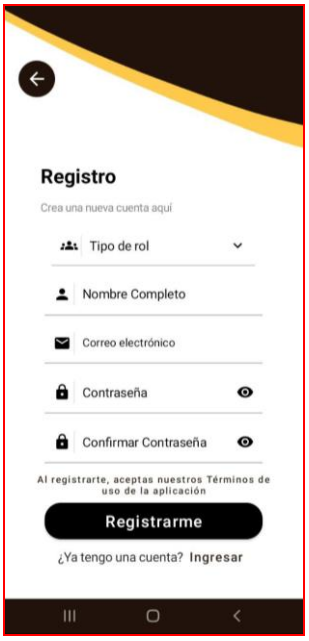

Fig. 3. Sign in in PARCE.

The PARCE application is accessed with the email address used to sign in and the password set by the user. Email is essential because all the notifications associated with the actions within PARCE are sent there.

The companies participating in the PARCE program, once signed in, must create a requirement, which basically consists of indicating the type of intervention they wish to receive. Then, based on the information provided, the administrator assigns the task to one of the internship advisors (depending on the area of knowledge requested). In turn, they assign the work to one or more students in the internship stage. The requirements module is only visible to the user under the "company" role and to the "administrator," who has access to all the information hosted in the application.

Every time a request is made, an alert is sent via email to the company and the administrator. Once the request has been created, it is possible to consult it in the company profile, delete it, update it, and consult the interventions received, as well as the files that have been uploaded as a result of that intervention (Fig. 4). Only the "company" role has permission to delete requirements.

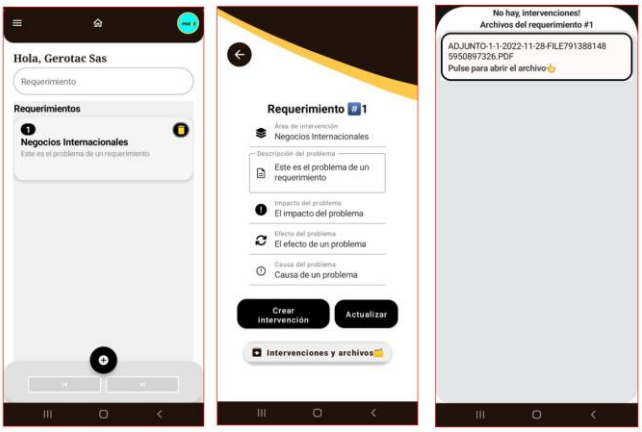

Fig. 4. Follow-up to company requirements.

The advisor is the one who can assign the requirement of a company to one or more students. This assignment is made in accordance with the complexity of the requirement, the judgment of the advisor, and the availability of students. Each time a requirement is assigned, an alert is sent via email to the student and the internship advisor.

The assignment of requirements to the internship advisors is a function enabled exclusively for the "administrator". The intention is to ensure that each internship advisor receives requests related to their area of knowledge and that there is an equitable distribution of requirements and students per advisor; because they endorse or not the interventions made by the students. Consequently, they are guarantors of the quality, opportunity, and credibility of the solution alternatives proposed to the company.

The interventions module allows students to respond to company requests with a PDF file that presents the progress of the proposal in detail (Fig. 5). When the student records an intervention, an alert (email to the advisor) is generated for the advisor to enter, review, and validate or reject the student's performance. That review results in a response of approval, or not, and the company would only receive notification via email for review, analysis, and relevant feedback if approved. When creating the internship laboratory, it was established that students must record at least 3 interventions during the semester: initial report, progress, and final report.

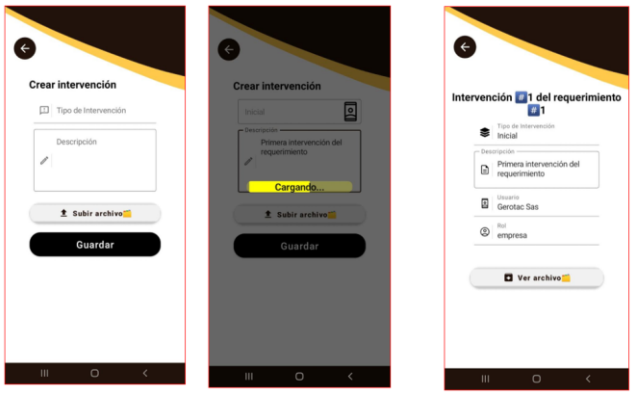

Fig. 5. Record of student-created interventions.

D. Didactic Support of the Parce Program

PBL, technological appropriation, and the mass use of digital devices made it possible that, through a mobile application, the training work is articulated to address specific needs of the companies. This training stage is crucial for students, therefore, new learning to face complex situations is vital. The production of innovations and creativity may link future professionals to the socio-economic and political development of the country [30].

The academic benefits of PBL are recognized in studies concluding that, based on this methodology, students' motivation is positively affected, even more so as the "problem" or "situation" is extracted from their closest reality [31]. It means that the PBL requires the entire institution to be involved [32] and favor an experiential approach in which the teacher guides the learning process [33], and students can play an active and critical role within their training process [34].

For its part, the ADR methodology seeks to solve problems through research. It is based on the participatory and collaborative approach, which promotes inclusion and diversity by fostering collaboration between the different actors of the university community. It implies collaboration in solving practical problems in specific contexts such as organizations, communities or educational institutions. This condition leads to collaborative learning through interaction, exchange of ideas and knowledge between members who perform a task. Its objectives not only include their performance, but also the development of individual and group skills. It requires an articulation among students [35], with the teacher, and with the means and materials [36], thus promoting the joint construction of knowledge [37] and learning in the cognitive, social, affective, and physical domains (motor performance) [38].

One of the main benefits of ADR is that it encourages the participation of those involved, which can lead to greater commitment and motivation to solve the identified problems. It is very useful, mainly in higher education, if we take into account that, in these contexts, professionals from different areas are prepared for the labor market [39]. All under the

premise that its implementation by ICT mediation can be effective, efficient, and pleasant [40] because service-learning—as a form of experiential learning that combines classroom teaching with service to the community [41]—can give additional motivation by inserting students in a context where their abilities are trusted and they are allowed to be proactive. It improves students' attitudes towards their academic and social formation, which will enrich the university community day by day and their projection towards the personal and professional future [42].

III. Methodology

To conduct the application study on the virtual internship laboratory by ICT mediation, the population was defined as the students of the Faculty of Business and Business sciences at Corporación Universitaria de Sabaneta currently in the 9th academic level (last of their curriculum), who were about to start the internship phase as a requirement to qualify for the degree. In addition, the participation of students who, because they were active workers at the time of enrollment, did not usually apply to the internship modality due to the economic repercussions of leaving their current jobs—not necessarily related to the academic program in course—was prioritized.

This decision was made because the self-assessment processes of the Faculty's academic programs showed that a significant number of students graduated without having the opportunity to face real situations associated with their discipline and their academic level. This hindered their employment opportunities in the specific field of their profession.

Of the total population (76 students) enrolled in the internship modality for degree option in 2022-2, a stratified sampling yielded 29 student-workers (those students who work at the same time as studying). They were selected as a sample to implement the virtual internship laboratory.

The other elements of the population (other students enrolled in Degree Option) did not participate in the research exercise because their student without a job status allowed them to carry out the internship in a face-to-face mode.

The inclusion criteria to select the sample of students were: (1) being an active student from one of the academic programs of the Faculty; (2) having completed the minimum number of credits required by the university to carry out an internship; (3) being able to sign internship contracts under an inter-institutional agreement (an agreement between the company and the university that, due to its flexible nature, allows the intern to have an employment contract with another company); (4) not having been academically sanctioned; (5) having access to a mobile device with Android operating system; (6) being linked to companies holding job positions not associated with the profession they are being trained for; (7) accepting to actively participate in the research exercise; and (8) preferably not having work experience in the training discipline.

A. Methodology for Approaching Companies

To collect data on the intervention needs of companies, a survey on key aspects associated with four areas of intervention related to the academic programs offered at the Faculty of Business and Business sciences was used: (1) internationalization, (2) accounting, (3) administrative-innovation, and (4) IT management. To gather the information and carry out the internship, the following stages were completed:

Stage 1. Design, validation, and reliability of the instrument: with theoretical support and associated with the scope of the Faculty's internships, we sought to determine and develop an instrument that allowed us to obtain information on the areas of intervention.

Stage 2. Field work for the application of the instrument: companies with which an internship agreement is in place were chosen because these were signed during the aforementioned academic programs' opening years, the initiative was also shared with students enrolled in levels 8 and 9 in the 2022-1 academic period. 384 MSMEs were interested in participating in the PARCE program and, 9 students linked to the CENICO research seedbed did the field work to apply the instrument. It consisted of a one-to-one visit to the company to survey the owner.

The inclusion factors taken into account to accept, or not, the application of a company were: (1) belonging to the MSME sector in accordance with the Colombian classification; (2) being registered with the Chamber of Commerce, that is, having active legal status regardless of economic activity; (3) having its operations center in the south of the Aburrá Valley or in Medellín; (4) accepting the possible assignment of interns to support them under the PARCE program.

Stage 3. Characterize and describe MSMEs with the validated instrument: information was collected from 384 companies as input to know their current status in the 4 dimensions susceptible to intervention by internships under the PARCE program. The instrument designed in Stage 1 was applied to the MSMEs under study.

Students, teachers, and people belonging to the companies signed their informed consent to be part of the research exercise. The data were treated under the applicable legal regulations, and the Ethics Committee of the Research Coordination of the educational institution approved and accompanied this process.

Stage 4. Development of the PARCE mobile application: based on an analysis of the academic requirements at Corporación Universitaria de Sabaneta to approve student's internships and the operation designed for the laboratory, the software architecture for PARCE was schematized.

Stage 5. Implementation of the PARCE program: a simple random selection was made among the 384 surveyed companies; usability and experience testing were applied to 82 people among students, teachers, and entrepreneurs. Training sessions were held on the use of the application with the companies selected to start the PARCE program, as well as with students and teachers who played the role of advisors. This training was carried out within the framework of the Faculty Internship Induction Days.

B. Data Collection and Analysis for Assessment by Entrepreneurs and Students

To collect the information, as part of the academic management processes carried out in the Faculty, a satisfaction survey on the internship process and the

performance of students was applied to companies. The survey was adapted to include aspects related to the implementation of the PARCE mobile application.

The instrument was applied to the 29 participating companies, the questions asked were grouped into four dimensions: (1) Academic processes; (2) Action- and Decision-oriented Research; (3) Impact of graduates on the field; and (4) ICT tool used. The participants were provided with an answer option according to the Likert scale.

The collected data was analyzed by descriptive statistics, due to its ability to summarize and organize them, thus providing a clear and concise description of the characteristics and patterns of the data. It can also be represented clearly and concisely in tables that facilitate the interpretation and communication of the results.

C. Implementation of the Virtual Internship Laboratory

To conduct the research, the interns were assigned to the companies to perform their function remotely by ICT mediation according to the internal procedures of Corporación Universitaria de Sabaneta. The receiving agencies (companies) certified the time each intern had a relationship with them, and this, under Colombian legislation, is considered work experience, thus helping them to improve their resume.

Once the students available for the exercise were identified through the PARCE mobile application, their resume was presented to the companies interested in having personnel from that academic program. Subsequently, they carry out the interview process and other internal requirements established by each company, and identify any possible abstention from receiving them as a designated intern.

Then, the companies were asked to sign in in the PARCE mobile application following the instructions given in the training sessions; then, the contact of the Administrator of the mobile application was shared with them, so that she could guide them in case of any concern or difficulty. The students and internship advisors also signed in.

Considering the companies requirements, the Administrator assigned the students to the corresponding internship advisor according to their academic enrollment record, and then assigned a requirement (request from the company) to the advisor, who, in turn, was in charge of assigning it to one of their students. From that moment on, they were officially responsible for meeting that requirement.

While the natural academic activities of the internship were carried out, the intern's relationship with the company was formalized under an inter-institutional agreement, using the format established for this purpose.

The internship advisors met with all the students in 2 group sessions, whose purpose was to open socialization spaces in which each student told her/his peers about aspects such as the problem assigned by the company, the applied research methodology, and most relevant findings. With that information, spaces for debate that enriched the perspective of each student and helped to generate valuable ideas for them to support each other were created.

Likewise, the same requirement or problem can be assigned to two or more students without altering the functionality of the mobile application. Since the internship regulations of Corporación Universitaria de Sabaneta stipulate that the internship must be carried out individually, there was no team assignment to address the same problem or requirement.

IV. Results and Discussion

The results obtained reveal that both the students and the participating entrepreneurs favourably assessed the mobile application in terms of usefulness in the learning process and relationship with companies. Participants highlighted that the approach based on the integration of mobile technologies and decision-making allowed them to better understand the concepts and develop practical skills in a meaningful way. In addition, there was high participant satisfaction in relation to the quality and relevance of the mobile application. Students highlighted its accessibility and flexibility, as well as interactivity and the possibility of receiving immediate feedback.

Entrepreneurs said that the virtual internship laboratory gave them the opportunity to interact directly with students, allowed them to evaluate their performance and offer guidance and advice in real time. They could have a clearer view of the competencies and skills of future professionals and establish closer relationships between academia and business. The results of the satisfaction survey, applied to the 29 participating companies, in relation to the internship process and the implementation of the PARCE mobile application are presented below for each dimension.

A. Academic Processes

Table 1 presents the descriptive statistics of four variables related to academic processes. The average ratings that respondents gave to this dimension can be classified as good or very good on a scale from 1 to 5. The average of the arithmetic means of the four variables is 4.52, and the average of the modes, that is, the most common value, is 4.75. It indicates that most of the participating companies agree or strongly agree with the teaching performance in the institution.

The average standard deviation of the variables is 0.57, thus indicating that they have a relatively low dispersion. The variables Training of teacher advisors and Application and assignment procedure were the best ranked by respondents.

Table 1. Descriptive statistics of four variables related to academic processes

	Quality of academic teaching	**Training of teacher advisors**	**Application and Assignment Procedure**	**Troubleshooting Involvement**
N Valid	29	29	29	29
Mean	4.2759	4.7241	4.5862	4.4828
Median	4.0000	5.0000	5.0000	4.0000
Mode	5.00	5.00	5.00	4.00
Standard Deviation	0.79716	0.45486	0.50123	0.50855
Variance	0.635	0.207	0.251	0.259
Skewness	−0.555	−1.059	−0.369	0.073
Standard asymmetry error	0.434	0.434	0.434	0.434
Kurtosis	−1.180	−0.950	−2.007	−2.148
Standard error of kurtosis	0.845	0.845	0.845	0.845

B. Action- and Decision-Oriented Research

The descriptive statistics in Table 2 show that from the perspective of the entrepreneurs, students obtained a good evaluation regarding their performance in research exercises, leading to alternative solutions to identified problems. The average of the four variables was 4.32. For this dimension, the average of the modes was 5, and the Adequate treatment of the information stood out as the best evaluated by companies. The ability to investigate problems was the one with the lowest average score.

TABLE 2. Action- and decision-oriented research on students' performance evaluation

	Ability to investigate problems	Relevance of the work plan presented	Adequate treatment of information	Quality of the final report submitted
N Valid	29	29	29	29
Mean	4.1379	4.2414	4.5862	4.3103
Median	4.0000	5.0000	5.0000	5.0000
Mode	5.00	5.00	5.00	5.00
Standard Deviation	0.87522	0.87240	0.62776	0.80638
Variance	0.766	0.761	0.394	0.650
Skewness	−0.283	−0.511	−1.279	−0.645
Standard asymmetry error	0.434	0.434	0.434	0.434
Kurtosis	−1.670	−1.518	0.686	−1.136
Standard error of kurtosis	0.845	0.845	0.845	0.845

Recognizing the importance of students knowing how to research and being familiar with the methods and techniques necessary to carry out rigorous and effective research, not necessarily for academic purposes, but adjusted to the needs of the business sector, it is considered that the ADR will help strengthen the skills associated with this element.

C. Impact of the Graduates in the Field

For higher education programs, it is of great interest to know the level of recognition that their graduates have, whether for their work performance, their social actions, among others. The impact of the graduate reflects in some way the success of the institution to train professionals capable of contributing to the development and progress of the society in which they operate. In addition, it can have a multiplier effect, since it can influence the image and reputation of the university, which impacts on its ability to attract high quality students and teachers, as well as motivate investment and support from the community and the business sector.

Table 3 shows that the arithmetic average of the means for this dimension is 4.28. It contributes to the continuous improvement of the academic quality at the institution and to making adjustments to ensure that the academic offer remains relevant and adequate to the needs of the labor market and society.

The variable with the lowest qualification is Second language skills. It requires important intervention especially in the case of International Business students. At present, it is considered that, as part of the characteristics of a global citizen, knowing a second language is highly valued in any social context.

Table 3. Descriptive statistics of five variables related to the perception of employers regarding the skills of graduates

	Relevan Academic Program	ICT Competences	Second language skills	Teamwork Skills	Ethical values
N Valid	29	29	29	29	29
Mean	4.5862	4.3448	3.9310	4.1724	4.3793
Median	5.0000	5.0000	4.0000	4.0000	5.0000
Mode	5.00	5.00	3.00	5.00	5.00
Standard Deviation	0.62776	0.89745	0.96106	0.88918	0.82001
Variance	0.394	0.805	0.924	0.791	0.672
Skewness	−1.279	−0.770	0.145	−0.360	−0.835
Standard asymmetry error	0.434	0.434	0.434	0.434	0.434
Kurtosis	0.686	−1.336	−1.992	−1.681	−0.965
Standard error of kurtosis	0.845	0.845	0.845	0.845	0.845

D. Dimension of ICT Tool Used

The ICT tool dimension corresponds to one variable included in the institutional format of Corporación Universitaria de Sabaneta; the questions on the Action- and decision-oriented research dimension were adapted from the previously existing format that conformed to it. However, since it was the first time that an ICT tool was used in the internship process, it was necessary to include it.

Table 4 indicates that the average of the arithmetic means for the three variables in this dimension was 4.49. This is considered a very positive result for our research interests since it is the first time that the PARCE mobile application was tested.

In general, the application of the instrument indicated that, although there are positive results, there is an important margin for improvement, especially in the dimensions Impact of graduates on the field and ADR skills.

Table 4. Descriptive statistics of three variables related to the quality of the PARCE mobil application

	PARCE app quality	PARCE app efficiency	PARCE app reliability
N Valid	29	29	29
Mean	4.5862	4.4483	4.4483
Median	5.0000	5.0000	5.0000
Mode	5.00	5.00	5.00
Standard Deviation	0.73277	0.82748	0.63168
Variance	0.537	0.685	0.399
Skewness	−1.490	−1.042	−0.706
Standard asymmetry error	0.434	0.434	0.434
Kurtosis	0.704	−0.677	−0.383
Standard error of kurtosis	0.845	0.845	0.845

Implementing a mobile application at Corporación Universitaria de Sabaneta internships represents an innovation in the training processes. This is a young institution (15 years), ICT was implemented as a result of the preventive isolation due to COVID-19 with the mandatory use of Moodle as a learning management system. However,

the results of this research are conclusive for the interests of Corporación Universitaria de Sabaneta because the mobile application and the internship program through the virtual laboratory were designed specifically to respond to a specific need: allow all students of the Faculty of Business and Business sciences to approach companies in which they could apply their knowledge and strengthen their skills. Nevertheless, this study can be a reference for other researchers who identify similarities with their academic environment.

The results obtained from the qualitative analysis of data offer an in-depth view of the implementation and effectiveness of this innovative initiative. Findings reveal that the didactic strategy modeled for m-learning has a positive impact on the business practice process in the university environment. Participants, including teachers, students, and entrepreneurs, recognize the flexibility and accessibility that the mobile application gives to internships and how it strengthens professional skills. This perception reinforces the hypothesis raised in this study and suggests that mobile technologies can play a significant role in promoting the relationship between universities and companies.

Exploring the factors that favor PBL as an integral part of the virtual internship laboratory has also yielded enlightening results. Participants highlighted the relevance of the PBL methodology to address real-world situations, which in turn contributes to the development of problem-solving and decision-making skills. These findings support the effectiveness of combining the PBL approach with the m-learning strategy as it provides an authentic and applicable learning experience.

The creation of a mobile application that fosters a direct approach between students and the productive sector has proven to be a crucial component of the university-business relationship. Participants expressed satisfaction when interacting with the app; it allowed them to apply their knowledge in real contexts and connect with industry professionals. This direct interaction has helped bridge the gap between academic theory and business practice, thus contributing to students' comprehensive preparation for their future career.

The assessment of the virtual internship laboratory through research instruments provides an objective view of its effectiveness. The average rating of 4.82 by employers reinforces the positive perception of this initiative and its contribution to the development of professional skills and abilities in students.

Together, the results of this research support the idea that an m-learning strategy combined with PBL can play a fundamental role in fostering the university-business relationship. The mobile application designed for this purpose has proven to be an effective way of linking students with the productive sector and strengthening their professional skills. These findings make a valuable contribution to higher education and to the collaboration with the business environment by driving the exploration of innovative and technological pedagogical approaches.

E. Discussion

After reviewing theoretical references, focused on exploring the factors that favor PBL, the objective of identifying relevant elements to apply m-learning to university internships is successfully met. The theoretical framework has been essential to understand and critically analyze the existing theories and approaches related to PBL and its implementation in virtual learning environments. The fundamental elements of PBL, considered by Corporación Universitaria de Sabaneta, what create an enriching learning environment that promoted the participation of students, the development of their cognitive and social-emotional skills, and the practical application of their knowledge in contexts outside the classroom when doing internships, are:

Authentic Problems: PBL is based on presenting authentic and relevant problems to students. These problems should be challenging and represent real-world situations, thus motivating students to apply their knowledge and skills to find solutions.

Collaboration: teamwork facilitates the analysis and resolution of the problems raised, encourages discussion, exchange of ideas, and the joint construction of knowledge. This interaction promotes critical thinking, effective communication, and teamwork.

Mentoring: The role of the tutor is critical in PBL because they guide and support students throughout the problem-solving process. Their role is to guide, stimulate reflective thinking, provide constructive feedback, and facilitate discussion and collaborative learning.

Use of Technology: In an m-learning model, the use of technology is leveraged to facilitate access to educational resources, enable online communication and collaboration, and offer problem-solving support tools. This includes the use of online learning platforms, mobile applications, multimedia resources, and synchronous and asynchronous communication tools.

Reflection and metacognition: PBL encourages reflection and metacognition, that is, knowledge and control over one's own learning processes. Students are encouraged to reflect on their progress, identify strengths and areas for improvement, and adapt their learning strategies. This promotes a greater awareness of their own abilities and continuous improvement in their learning process.

The positive assessment of the mobile application is relevant for this research because the strategic relationship of the University with companies is key. The purpose is not only to confront students with real situations in the labor market, but also to strengthen links to have a greater impact on the community and be able to verify the compliance with the declarations of student's training and graduation profiles by their academic program. As the research carried out proposes the strengthening of the university-business relationship through the development of internships by ICT mediation, the following are identified as strategic foundations:

Research and analysis of the training needs of students and the business sector: It involves identifying the competences, skills and knowledge required for professional practice in the business field, as well as the analysis of the training needs of students in relation to these competences.

Virtual internship laboratory: It refers to the design and development of a virtual learning environment that enables

the interaction of all students with the productive sector regardless of their additional occupations, thus guaranteeing equality and democratization of educational practices.

Evaluation and continuous improvement: This principle refers to the periodic evaluation of the proposal with the aim of identifying strengths, weaknesses, opportunities for improvement, and making the necessary adjustments to improve its effectiveness.

In addition to this, four pillars that generate deep partnerships are established to achieve the objectives:

1) **Research:** Carry out studies and analysis of the current relationship between the University and the Company, identifying the needs and demands of both parties, to design an effective and adequate program.
2) **Technology:** Use technological tools that allow the creation of an m-**learning** platform that integrates PBL and ADR to improve interaction and collaboration between students and the business sector.
3) **Curriculum development:** Verify that the curriculum allows integrating PBL and ADR into the learning process, so that students acquire the skills and knowledge necessary to face the challenges of the business world.
4) **Strategic alliances:** Establish agreements with companies and institutions in the productive **sector** to implement the m-learning + ADR program, and thus achieve a comprehensive and practical training of students.

V. Conclusion

The results obtained from this research consistently indicate that the implementation of the "Academic Program for the Relationship with Companies (PARCE)" and its focus on integrating mobile technologies has had a positive impact on both students and entrepreneurs. These conclusions are drawn from the favorable assessment and observations made about the mobile application and the virtual internship laboratory.

Both students and entrepreneurs positively rated the mobile application in terms of its usefulness in the learning process and relationship with companies. This finding supports the effectiveness of the implemented m-learning strategy. Participants highlighted that the approach based on the integration of mobile technologies and decision-making allowed them to understand concepts better and develop practical skills in a meaningful way. It suggests that the mobile application has effectively contributed to learning and competence development.

Accessibility, flexibility, interactivity, and immediate feedback were highlighted by students, thus supporting the usefulness and acceptance of mobile technology in the educational context. Entrepreneurs expressed that the virtual internship laboratory provided them with the opportunity to interact directly with the students, evaluate their performance, offer guidance in real time, and have a clearer view of the competencies and skills of future professionals. This interaction strengthened the connection between academia and business.

VI. Recommendations

Given the relevance and significant implications of the "Academic Program for the Relationship with Companies" and its focus on m-learning to foster the university-business relationship, there are several subjects for future research in this field.

Long-Term Evaluation: Long-term follow-up of students who participated in the program and examine how acquired skills and experience influence their career paths and adaptation to the labor market.

Comparison of Didactic Approaches: Contrast the effectiveness of the Problem-Based Learning (PBL) approach with other didactic approaches in the context of m-learning for internships and analyze which of them has a greater impact on the development of professional skills.

Effectiveness at Different Educational Levels: Explore the applicability and effectiveness of the program at different educational levels, from technical education to advanced higher education.

Impact on Employability: Investigate how participation in the m-learning program can influence the employability of students, considering factors such as the acquisition of transferable skills and the improvement of job adaptability.

These recommendations will serve as a starting point for future research that will continue to explore and broaden the understanding of how m-learning can strengthen the relationship between universities and companies, and its impact on the development of professional skills in students.

Recognition of difficulties identified during research may also be useful for future research:

Technological Development: The creation and implementation of the mobile application required technical skills and specialized knowledge, making it necessary to collaborate with external developers. It generated delays in the technological implementation of the program.

Application Design: The design of the mobile application must be intuitive and adapted to the needs of students and professionals. Ensuring that the interface was friendly and functional presented challenges in terms of user experience design and graphic design.

Administrative Coordination: Coordination and communication with the educational institution and the companies involved in the program required considerable administrative effort. Aligning agendas, implementing logistics, and obtaining permits required additional time and effort.

Ethical and Privacy Challenges: The collection and use of personal and academic achievement data raised ethical and privacy concerns that needed to be addressed appropriately to protect participants' rights.

Despite these difficulties, lessons learned, and solutions adopted in the research process contributed to the continuous improvement of the "Academic Program for the Relationship with Companies". The difficulties identified also offer valuable opportunities for future research and enrich the understanding of the challenges posed by integrating m-learning into academic and business environments.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Sandra Torres-Taborda carried out the research and accompanied the design and development of the PARCE mobile application as part of her thesis to apply for the title of Doctor in the Knowledge Society, in Training, at the University of Salamanca, Spain. Sonia Casillas-Martin, and Marcos Cabezas-Gonzalez accompanied the research as thesis advisors and supervised the production of this article. All authors have approved the final version.

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