Teachers' capacities to incorporate m-learning strategies in their teaching and learning processes. Study of a Colombian case*

Capacidades de los docentes para la incorporación de estrategias m-learning en sus procesos de enseñanza y aprendizaje. Estudio de un caso colombiano

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Abstract

This contribution presents the results of a project that aims to promote the reflective use of mobile devices in teaching-learning processes in educational institutions in the Urabá region, in Antioquia (Colombia). The first phase of the project consists of a diagnosis, based on an instrument, field visits, and workshops with teachers and managers. Two central aspects are highlighted from the results: most of the teachers have postgraduate training and evidence a basic level of skills for the use of ICT. The design and implementation phase was affected by the crisis generated by the COVID-19 pandemic. Therefore, in this phase virtual strategies were developed to finalize the training process on m-learning with teachers from the region. The study confirms that teachers have an adequate disposition to incorporate mobile learning didactic strategies.

Keywords
ICT, smartphone, m-learning, teaching with multimedia, basic education.

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Resumen

Se presentan los resultados de una investigación que tiene como propósito promover el uso adecuado de los dispositivos móviles en procesos de enseñanza-aprendizaje, en instituciones educativas de la región de Urabá en Antioquia (Colombia). Durante la primera fase del proyecto se realiza un diagnóstico, a partir de un instrumento, de visitas de campo y de talleres con docentes y directivos. Entre los resultados, se destaca que la mayoría de los docentes cuentan con formación de posgrado y evidencia un dominio de competencias básicas para el uso de las TIC. La fase de diseño e implementación se ve atravesada por la crisis generada por la pandemia de covid-19. Por tanto, en esta fase se desarrollan estrategias virtuales para finalizar el proceso formativo sobre m-learning con docentes de la región. Se confirma que los docentes tienen una adecuada disposición para la incorporación de estrategias didácticas de aprendizaje móvil.

Palabras clave

TIC, teléfono móvil, *m-learning*, enseñanza multimedia, educación básica.

Introduction

The project "Ecosistema de contenidos digitales para Apps al servicio de procesos de enseñanza y aprendizaje en Antioquia" was executed during 2019 and 2020 by researchers from three research groups in the fields of communication, education and informatics, with the support of a technology-based company. It aims to create thoughtfulness regarding the use and appropriation of the resources offered by mobile learning to boost didactic strategies that assist online learning in the context of Urabá's subregion and, through a suite of digital resources, boost the digital skills available in the territory to promote ubiquitous learning from the needs and expectations of the subregion teachers.

The research is developed in the subregion of Urabá (Antioquia), a tropical territory with an agricultural vocation, Caribbean coasts, and great biodiversity that also has considerable afro-descendant and indigenous populations as well as a significant rural dispersion. The region has a great port and touristic potential for the infrastructure projects portrayed in the mid-term (Gobernación de Antioquia, 2016).

Nevertheless, Urabá suffers a structural social inequality and has poverty indexes above the average in Antioquia. According to data from Dane (2019a), multidimensional poverty affects the residents of urban areas in a differential manner, reporting 11.8% of the residents of urban capitals in the Department of Antioquia being in this condition, while 36.8% of the residents of rural areas were in multidimensional poverty condition in 2018.

According to United Nations data (UN, 2015), the poverty in rural territories is three times higher than the poverty in urban areas. Colombia is one of the most unequal countries in the world, with a Gini index of 0.517 as per data of 2018 of Dane (2019b), which indicates a high level of inequality, resulting from deep structural faults in the income distribution and opportunities. In accordance with the National Economic and Social Policy Council (Conpes, 2018), the need of increasing formal employment, diminish informality, and the number of individuals that work but earn daily incomes lower than 1.25 to 2 dollars stand out from the persistent challenges in the battle against poverty and inequality.

For an incorporation program of didactic strategies of mobile learning to be effective, interventions must be considered in three areas: training of teachers and managers, access to devices, and provision of infrastructure that serve as support for the M-learning strategy (Mojarro-Aliaño, 2019).

This project also develops a technological component, which contributes in terms of the functionality of the devices and enables connectivity. However, this article is focused on the training of teachers of the region's institutions. This article aims to present the results of an initial diagnosis consultation applied to the teachers of the region who are involved in the project, during the first field visit, to identify the

situation of media and digital literacy of the participating teachers in the region of Urabá. This exercise is compared with theoretical referents and with the assessment instrument applied in the final stage of the project.

Within the context of the global health crisis resulted from the COVID-19 pandemic which leads to mandatory lockdown in Colombia as of March 2020, the educational institutions have opted for virtual education to continue executing their mission. Due to the connectivity advances, it has been possible to stay connected with one and other, to continue with the higher education processes, and with several productive activities. In few months, the process of incorporation of ICT to teaching has been enhanced and the need of the educational community of having capacities and skills has increased to obtain the best educational results possible in this contingency. A team of Mexican researchers inquired a representative sample of teachers in their country and concluded that:

Teachers have been creative in their didactic strategies with traditional resources that have always been used and a limited suite of digital tools due to the Internet access at home. It is seen in the teachers' emotions that, even though it has been difficult for all of them, there are positive feelings for the achievement of continuing the academic cycle.

Despite the conditions not being always the best, the teachers creatively diversify strategies and resources to pass the expected learnings (Baptista et al., 2020, p.82).

According to Baptista et al., (2020) among the main challenges, it stands out the fact that not all teachers have the skills to promote learning in digital environments, to motivate and invigorate the inclusion of their students, and to assess their performance.

Within this context, one of the challenges is to reduce the risk of scholar desertion, as a complex phenomenon that presents significant differences in diverse territories of Colombia. The average rate of national desertion was 3% in 2018, according to the Economics of Education Laboratory of Universidad Javeriana (2020), which states that measures such as suspension of on-site lessons and their continuity in virtual lessons may impact an increase in scholar desertion in the country.

In Colombia, there are gaps in educational coverage, particularly in the most vulnerable sectors of the population, among which, the rural population is found. The school expectancy has increased for the six years cohort and there is also a significant increase in the average of years of education of individuals between 24 and 35 years of age, which was of 8.5 years in 2001 and has incremented to 10.5 years in 2015. However, with considerable differences between the different regions in the country and the cities and rural areas (Rojas, 2019).

Thanks to the progress in the coverage of ICT access, access strategies are promoted, such as those from Universidad Digital de Antioquia[4], which enable access to people of remote communities and also to those individuals that, due to multiple commitments, both of employment and personal, can be also benefited from virtual modalities. Nonetheless, the public policies that favor access must also ensure the quality of educational opportunities, as established in the research of Rivera and Zavala (2020), regarding programs of virtual education offered to rural communities and impoverished urban sectors. Hence, the social inequality is deepened because "if the education received by the students is not quality education, it will continue to create an exclusion for low-income communities" (Guerrero and Soto, 2019, p. 128).

Theoretical foundation

Media literacy: the dynamic relationship between communication and education

The process of digital content production and consumption in the contemporary society

4 Available at: www.iudigital.edu.co

requires the recognition of complex conditions, in the context of the so-called information society (Castells, 2009), characterized by the increasing levels of connectivity and the upsurge of the information flows, with an impact in all spheres of life: education, economy, employment, interpersonal relationships, culture, participation, politics.

As stated by Jenkins (2008), it is necessary to acknowledge it as a culture change and not only as a technological change. Digital scenarios have boosted the emergence of a new communicative model that, according to Castells (2002), is characterized by many-to-many communication processes that pass unidirectional and hierarchical schemes. Thus, the users may also be content creators in a dynamic emitters-receivers role, called Emirec or Prosumer (Aparici and García-Marín, 2018).

Accordingly, the traditional relation between teachers and students evolves towards a more horizontal model, where interaction obtains prominence, the teacher is transformed into a facilitator and the student becomes more active, as part of the participative culture. The group gains prominence as a consultation, dialogue, and collaboration space (Osuna-Acedo, Frau-Meigs, and Marta-Lazo, 2018).

Hyperconnectivity and ubiquity of mobile access and through multiple screens represents a change in the content consumption, which must be adapted to multiple devices, as a component of transmedia narratives (Jenkins, 2009), to connect the different set scenarios so that the user determines their journey and info diet, which requires responsibility, criteria, and analysis capacity.

However, even though the users' capacity of operational functioning to access the information is increasing, the risk of misinformation is reinforced. Several pieces of research confirm that for many users, particularly those who are young, it is impossible to differentiate between fake news and conventional informational content (Buckingham, 2019) since in many instances, the users lack more complex media and digital literacy to select and filter information and constitute an info diet (Romero-Rodríguez et al., 2016).

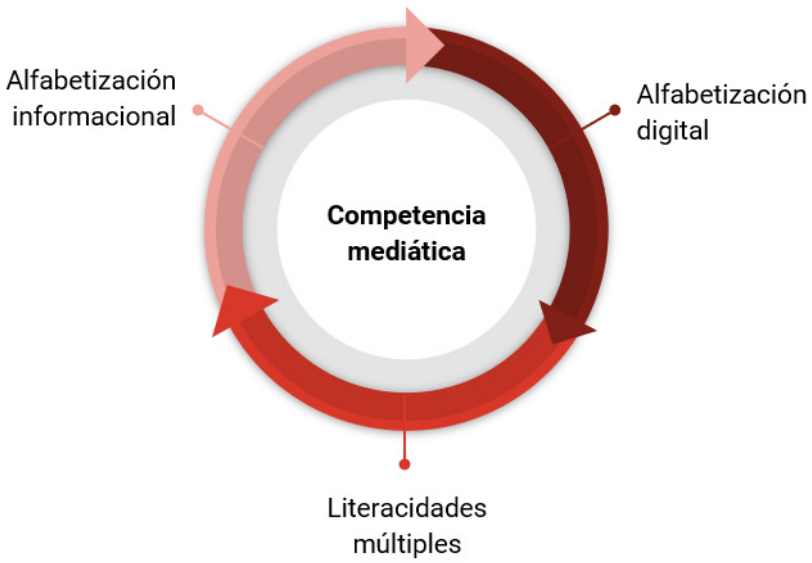

Figure 1: Multiple literacies in the media ability. Prepared by the authors.

In the contemporary information society, in digital environments which lean towards saturation, media and digital abilities are an alternative for the users to strengthen their skills to adequately select their cultural consumption critically and also so that they can be creators of digital content (Aguaded y Romero-Rodríguez, 2015). It is a complex and lengthy training process, as evidenced in the following figure:

As wide context, the reinforcement of the process of globalization of culture in the scenario of information societies and knowledge are recognized, which require training of an active and competent citizenry in a suite of abilities and media and digital skills (Ferrés and Piscitelli, 2012).

Media literacy is a dynamic process of increasing complexity that "updates the discussion regarding informational, communication, audiovisual, and digital skills, crucial in the educational-communicative processes, that aim to improve the capacities of the citizens as users, consumers, and producers of different types of contents" to be entitled as prosumers and as world citizens (Lotero-Echeverri, Romero-Rodríguez, and Pérez-Rodríguez, 2019, p. 13-14).

In Colombia, the amount of phone lines exceeds the number of residents, as evidenced in Table 1, which accords with global trends. Mobile devices are placed as the most used screen, currently and increasingly,

to connect to the network and consume and produce content in a ubiquitous manner, particularly between young users, and among these, the students of educational centers. On a world scale, in 2018, Internet access from mobile devices corresponded to 52% of the Internet traffic (Mentor, 2020). According to Márquez (2017), the smartphone is a meta-media device, a platform in which numerous services come together, "a kind of 'universal remote control' capable of storing the different uses and features of multiple media systems" (p.1).

One of the most frequent uses of smartphones is engaging in digital social media platforms. In themselves, they can be a resource for learning: "As communication spaces and ability development" (Pérez-Escoda and Contreras, 2018, p. 288). These platforms are also important in the lockdown context, to enable communication between teachers, students, and parents. According to the research of Escobar-Mamani and Gómez Arteta (2020):

WhatsApp, as a didactic resource, develops communication skills in the students of secondary education helping them understand and create oral and written texts more maturely and responsibly, entertainingly promoting self-learning, making them feel part of the technological era of knowledge. It is a highly motivating resource that allows the student to learn entertainingly and to have a more personalized relationship with the teacher, which fills them with confidence to create their texts (p. 118-119).

Learning assisted with mobile devices, mainly smartphones, known as *mobile learning* (M-learning) is an emergent process that serves to the access and consumption characteristics of the youngest users, it adapts to their consumption patterns, so it can improve accessibility and motivation and takes advantage of the facilities of smartphones to incorporate multimedia and interactive strategies.

The M-learning represents deep challenges for teachers on a methodological level, according to the areas and educational levels, to promote autonomous learning and collaborative dynamics among the students in virtual environments (Fombona et al., 2017). The multimedia nature of the digital scenarios, where a process of alignment of media and formats, stands out (Jenkins, 2009). In this sense, the capacity for the "creation of contexts, namely, the ability to integrate characteristics and practices in diverse contexts represents one of the main competencies for action (agency) (Rummler, Grabensteiner, and Schneider Stingelin, 2020, p.109).

courses, known as MOOC (for its acronym in English), which are developed by recognized universities across the world (Osuna-Acedo, Marta-Lazo, and Frau-Meigs, 2018).

Persistent digital gaps in environments of severe inequality

Over half of the 1,500 million students without classes due to the COVID-19 pandemic, which has forced the closure of educational institutions in 191 countries, do not have computer devices to access distance learning classes and 43% do not have Internet access, as stated by Unesco (2020).

According to the research of the Economics of Education Laboratory of Pontificia Universidad Javeriana (Pesquisa Javeriana, 2020), in Colombia, 96% of the municipalities do not have the resources nor the coverage to implement a virtual modality. While over a million residents of rural territories do not have internet service, according to the 2008 data of Mineducación.

To achieve the purpose of promoting awareness regarding the best teaching and learning practices within the context of new learning environments mediated by ICT, it is necessary to acknowledge the situation regarding access to information and communication technologies (ICT) and the installed capacity of connectivity that the residents have in their homes, as evidenced in the following table:

Table 1. Access gap in Colombia

Broadband internet access	6.96 million 13.8 /100 residents
Prepaid Access to mobile internet	30.9 million
Postpaid Access to mobile internet	18.28 million
Prepaid mobile phone lines	52.3 million
Postpaid mobile phone lines	14 million

Source: data by MINTIC (2019).

Mobile learning strategies are an alternative to boost learning over the course of a lifetime. They also serve as a platform to access millions of massively open online.

According to data of the Departamento Nacional de Estadísticas (Dane, 2019c), in Colombia, the students of the formal educational system, in the educational levels of pre-school, basic, and secondary education, are distributed as follows: 80.4% are enrolled in public institutions and 19.6% of them are in private institutions. While 76.3% attend urban educational institutions and 23.7% attend rural educational institutions. As for the access of ICT goods and services in the educational institutions, in 2018, 37.4% of the public institutions had internet access while 96.6% of private institutions had internet access. Moreover, 26.9% of the rural institutions had internet access, in contrast to the 89.2% of the urban institutions.

Methodology

This study is descriptive since it intends to explore and systematize the significative characteristics of the population under study (Hernández Sampieri et al., 2014). During the first two visits of the research team to the region in the second semester of 2018 and first semester of 2019, fieldwork was performed with educational communities of the municipalities of Apartadó, Carepa, and Necoclí, on both urban and rural educational institutions. These three populations were selected since they represent the region's diversity. This diagnosis work was based on direct observation and interviews with teachers, coordinators, and managers of thirteen educational institutions. Likewise, workshops of co-creation of experiences of ICT tools appropriation in learning processes were carried out.

At the beginning of these workshops, the teachers were also asked to answer a survey to identify their levels of access and use of ICT in general and particularly, applied to the teaching and learning processes.

The printed survey was taken by 94 teachers of the three municipalities during the training workshops. The instrument comprised 111 questions, including a section of sociodemographic characterization of the participants, a diagnosis of the situation of access to ICT, and connectivity both in their educational institutions and

at home. A section regarding media consumption and a section comprising the incorporation of ICT in teaching were also included. Survey[5] was prepared based on the researchers' experience and the background check.

The execution phase of the project was affected due to the health crisis resulted from the COVID-19 pandemic, which led Colombia to a mandatory lockdown as of March 2020. As in other social life spheres, the educational institutions were forced to continue the academic year through virtual education strategies. Faced with the impossibility of continuing traveling to the region to develop the events and training workshops for participating teachers, the researchers opted for designing a virtual training strategy, based on synchronous events by video calls and the designation of challenges and activities for the application of technological tools and *microlearning* to strengthen the process of ICT appropriation of the teachers, in instances of quarantine and to accompany them in their distance teaching role. In this virtual stage of project implementation, desertion of some participating teachers occurred, of the close to 100 who started on the on-site phase. It was managed so that 35 of them completed their training process, after the approval of the co-creation workshops aimed at the appropriation of tools for mobile learning.

In the final phase of this virtual accompaniment, an instrument was applied to the participating teachers, to inquire about their grading of the training experience and disposition to incorporate *microlearning* strategies designed for mobile devices into their teaching practices. The instrument[6] comprised 28 questions regarding the appropriation of mobile devices to the service of teaching and learning processes and was designed based on the project's experience and background check. Twenty-seven teachers of the region completed the survey in the *Google Forms* platform.

Results and discussion

As a strength, it is identified that the training level of most of the inquired teachers corresponds to post-graduate studies: 68.8% have masters and 31.2% have a specialization study, which may be an opportunity for the achievement of the aims. In addition, 53.2% have taken training programs in the use of ICT in the past 5 years. Hence, there is a teachers' team with a base training level that can enable the incorporation of ICT in teaching.

As a weakness, a low quality of connectivity is identified. 40.9% stated that there is no internet signal in their educational institution. Yet, in most of the institutions, internet access is precarious, since frequently, the connection speed is only sufficient for the usage of one computer room, which limits the access of students and teachers. For this reason, some teachers declared as the main impediment that they must carry their own computer and use their internet plan.

During the initial diagnosis, teachers considered that using the mobile device would increase their work since it requires control and becomes a distracting factor for their students in the classroom. Additionally, attention is drawn to the fact that 61% of the teachers report an experience in the use of mobile phones of between 1 and 3 years.

Only one of the inquired teachers stated that they do not have a mobile phone, while 95.7%

use a mobile device to navigate the internet, which implies access to smartphones. Yet, 81.9% declared to have a mobile data plan on their mobile phones. However, in rural areas, there are limitations in the mobile telephone signal, since 12.9% of the inquired teachers stated that they do not have mobile phone signal in their educational institution.

Despite the described connectivity limitations, over half of the inquired teachers use mobile devices for educational purposes daily, as evidenced in the following figure:

5 Initial survey available at: https://forms.gle/JRg9QpB4GEs9A4HbA
6 Final survey available at: https://forms.gle/ZxvEicV4tiWGgFyx5

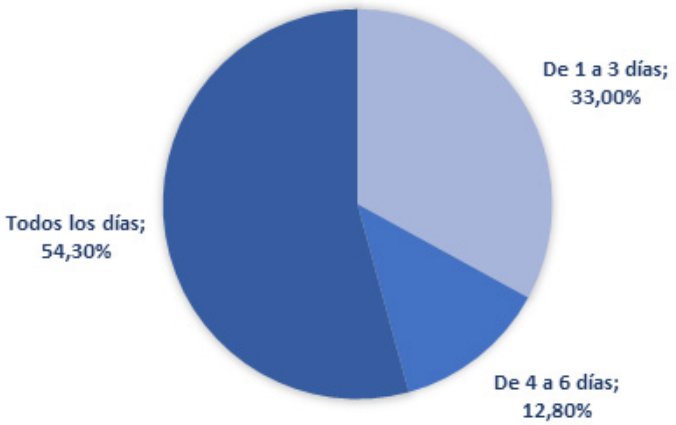

Figure 2: frequency of usage of devices for educational purposes

The teachers were inquired regarding the use of mobile devices in teaching and learning processes, among which the following stand out:

Table 2. Main uses of mobile devices in educational processes

Uses	They do it with help	They do it by themselves	They do not do it
Download files	9.6%	83.0%	7.4%
Send and receive e-mails	10.6%	76.6%	12.8%
Download applications	10.6%	75.5%	13.8%
Consult or download educational content	5.3%	87.2%	7.4%
Publish images, audios, and or videos	3.2%	80.9%	16.0%
Carry out public institutional procedures (RUT, passport, DAS appointment, RUNT, transit procedures, Pila, payment of taxes, etc.).	6.4%	37.2%	56.4%
Engage in online educational processes (e-learning)	3.2%	51.1%	45.7%
Publish texts	2.1%	55.3%	42.6%
Engage in discussion forums	2.1%	42.6%	55.3%

As evidenced in the above table, the teachers declare to have a medium autonomy level, in most of the functions inquired. The teachers being competent is a necessary condition for them to contribute to the media and digital literacy of their students: "for the teachers to be digitally competent in the information area and informational literacy, they must have a series of skills to allow them to adequately transmit them to the students to promote their key competence, called digital competence" (Moreno-Guerrero et al., 2020, p. 11).

In addition, 67% states that they prepare their lessons using the internet and a mobile device, while 69.1% use a mobile device in the classroom. Regarding the more active functions, 47.9% have published educational content on the web. From this number who claim to publish content, only 44.9% are content of their authority. These strengths in the teachers' digital competencies are crucial to contribute to the reduction of the in their educational community (Pérez-Escoda et al., 2020).

Main findings at the project's closure: After they participated in the project, the inquired teachers were asked to grade a series of statements regarding the incorporation of ICT into teaching, particularly through m-learning, using a Likert scale with four levels of agreement.

64% of the inquired teachers strongly agree, and 33% of them agree that employing m-learning in their teaching role would be useful. While 59.3% strongly agree and 40.7% agree that m-learning allows them to complete their tasks faster.

In terms of their training process for the incorporation of ICT in teaching, 48.3% of the teachers agree and 46% strongly agree that become skilled in the use of m-learning would be easy. This indicates a good disposition towards these strategies, which is improved since 65.2% of the inquired teachers strongly agree and 26.1% agree that they have the necessary resources to be trained through m-learning.

Concerning the necessary pieces of knowledge to be trained through m-learning, most of the inquired teachers state that they do have the necessary level of knowledge, as indicated in the following figure:

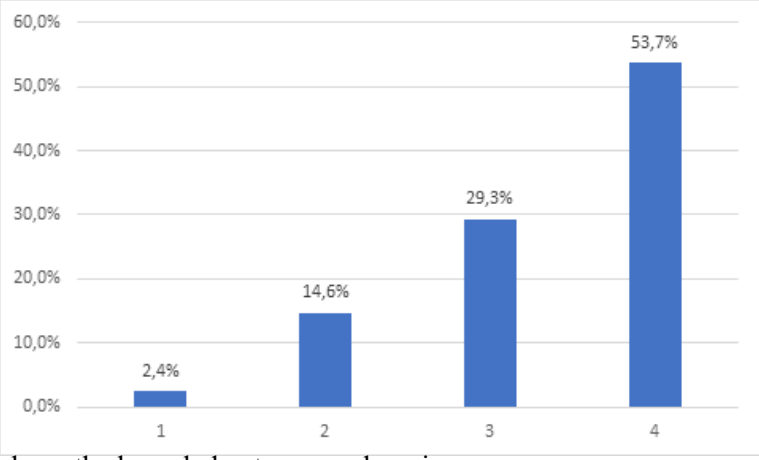

Figure 3: teachers have the knowledge to use m-learning

Among the advantages of the incorporation of these m-learning strategies in their learning and teaching processes, 79.2% of the teachers strongly agree and 20.8% agree that using them will make learning more enjoyable.

Concerning their students, 76% of the inquired teachers strongly agree that during the use m-learning by students, teachers would be a great help. Additionally, 42.3% of the teachers agree that by using m-learning, the student does not need to be supervised, since it is self-disciplined, as indicated in figure 4. This perception of the teachers matches with the research of González and Del Carmen (2018), who inquired middle school students regarding the use of mobile technology and confirmed that "it enabled them to experiment feelings of self-efficiency in the development of their learning activities" (p. 224).

Consistent with the foregoing, 39% of the inquired teachers strongly agree and 51.2% agree that the student is capable of managing their studying time effectively and can complete their tasks on time, by using m-learning.

Finally, when asked whether they plan to use m-learning in the next 12 months, 65.9% of them strongly agreed and 26.4% of them agreed, which indicates the interest of the participating teachers in the use of these resources. This good disposition of the teachers towards strategies of mobile learning is a favorable

condition for the advantage of their potentialities in their processes of teaching and learning. Mainly, because it is necessary to acknowledge that, as all innovative practices, the incorporation of m-learning didactic strategies represents complex challenges for the teachers such as technical issues, as well as issues related to the interaction with their students, mainly, of a pedagogical nature (Mojarro-Aliaño, 2019).

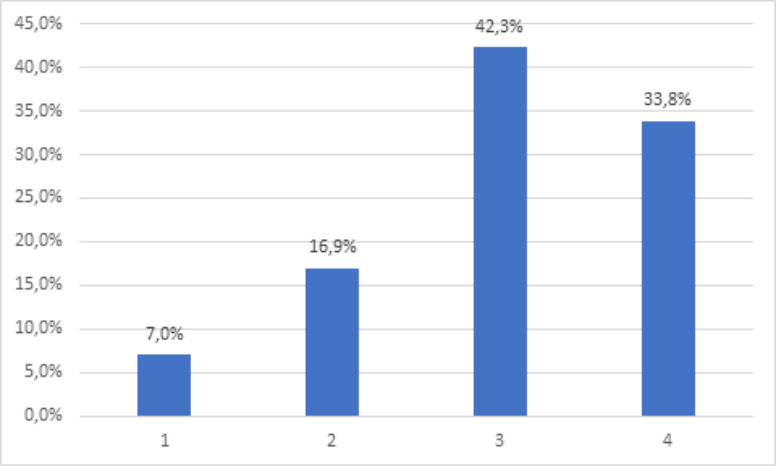

Figure 4: the student does not need to be supervised while using m-learning

Conclusions

The pandemic crisis has reinforced the need to strengthen the media and digital literacy of all parties in the educational community. In times of complex crisis, with health, social and economic implications, reliable and prompt information is required as input for the users to make decisions in unprecedented risk situations. According to the research of Masip et al. (2020), "the citizens have clearly modified their information consumption habits during lockdown" (p. 7). Digital media and digital social network platforms are positioned as the main sources to be informed. Within this context, the risk of misinformation is also increased, consequently, the World Health Organization (WHO, 2020) has alerted about the infodemic threat.

Hence, within this context, the didactic strategies for the incorporation of ICT in the teaching and learning processes become more valuable, particularly, those that contribute to boosting the advantage of mobile devices as the most commonly used screens by young people and students and may be boosted as tools to serve ubiquitous learning.

In this study, it is confirmed that the teachers who participated in the project have a high training level and adequate control of basic digital literacy competencies for the incorporation of ICT in teaching. It is drawn to attention that, after they participate in the project, teachers noticed that they have the necessary skills to use didactic strategies of mobile learning in their teaching and learning processes and that these can be relevant to involve their students more actively.

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