



## LEARNING ECOLOGIES IN SECONDARY EDUCATION: ICT AND INFORMAL LEARNING

Musbah Said Farag Saleh<sup>1</sup>; Ebtisam Omar Ghait Omar<sup>2</sup>

<sup>1</sup>Lecturer, Higher institute of science and technology Marada, Libya, [mosbahalkul@gmail.com](mailto:mosbahalkul@gmail.com)

<sup>2</sup>Lecturer, Higher institute of science and technology Marada, Libya, [alkul2013@yahoo.com](mailto:alkul2013@yahoo.com)



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### ABSTRACT

It is known that currently, the students learn in different contexts and with extensive use of information and communication technologies (ICT). This study aims to identify which applications, web platforms, social networks, and digital technologies a group of secondary education students uses through a self-administered questionnaire. First, we will refer to the "learning ecologies" concept and its link with informal learning and ICT. The "Material and methods" section includes the participants' characterization and a detailed description of the instrument used. Results are organized into four categories. In the discussion, we propose the impact of technologies on several aspects of the participants' lives.

## 1. Introduction

The stories that people have concerning their learning ecologies are diverse. The Simpsons creator grew up surrounded by illustrations by his father, a cartoonist and film director. In their childhood and adolescence, together with schoolmates, they drew comics. They made short films receiving influence and inspiration from other artists, such as John Lennon, whose books contain drawings that Matt himself tried to imitate. His interest in cartoons led him to develop the ability to draw during class hours without looking at the paper so that it seemed that he was paying attention to the teachers. Over the years, already in Los Angeles and after several frustrating jobs, Groening created the television series The Simpsons, which is still broadcasting its thirty-second season. In this example, we can glimpse the influence of family, friends and famous people in the cartoonist's learning trajectory and a progressive approach to technology as a tool for creating drawings and animations (Abdullah et al., 2019).

Like Groening, today, young people learn in very different ways, in different contexts and using various tools, among which technologies are becoming predominant. The opening to new flexible learning modes is given, in part, by the new mobile technologies and digital resources that currently exist. The opening to new flexible learning modes is given, in part, by new mobile technologies and digital resources that currently exist. This work presents the results obtained from a questionnaire on digital technologies applied to high school students. Its objective was to expand knowledge about the applications, web platforms and digital technologies that students use inside and outside of school institutions (Ahmad, 2020).

The interest in this lies in the importance of recognizing the large number of learning activities that occur in these contexts, which enable students to create and manage their trajectories. First, this paper will present a theoretical development about learning ecologies and ICTs and their link with informal learning as concepts that support and justify the importance of work. Second, they will expose methodological aspects within which the characteristics of the questionnaire on digital technologies used will be detailed. Then, the results section will present the primary data obtained from the instrument used, organizing the analysis into four categories. Finally, some discussions and conclusions derived from the writing will be presented (Aich et al., 2018).

## 2. Literature Review

When considering the different contexts in which people participate and learn, the concept of "learning ecologies" becomes relevant, useful for understanding technology-mediated learning and the interconnection between environments. Ali et al. (2018) defined learning ecologies as dynamic entities characterized by a set of contexts formal, non-formal and informal that provide learning opportunities, each of which contains certain activities, resources, relationships and interactions inherent to them. The notion of "ecology" derives from studies on ecosystems to refer to the dynamic interrelationships established between organisms and their environment Aldholay et al. (2020). Numerous authors

adopted this metaphor to understand the characteristics that learning assumes throughout time and in different settings so that individual differences in personal learning trajectories are considered. In line with the case presented here, a look from learning ecologies highlights that young people participate simultaneously in many contexts and intervene in various practices and forms of knowledge outside of school (Aich et al., 2018).

This new conception assumes that learning is multidirectional and multimodal, which is why there is a distancing from the conceptualization of this process linked only to school institutions to begin to understand it in a variety of settings: the home, the workplace, the library, the place of play, the museum, the park and in everyday interactions with others. In this way, an ecological look enables one to learn from less formal sources, resources or contexts. Thus, when speaking of «learning ecologies» we consider three aspects: first, the fuzzy boundaries between formal, non-formal and informal settings; second, a situated conception of our learning; and, thirdly, a high level of personalization of this process (Al-Absi et al., 2017).

According to what was previously expressed, the notion of «learning ecology» helps understand the hybridization of contexts from ICT, integrating formal, non-formal and informal opportunities to improve lifelong learning and increase the possibilities of development and performance. The notion of «learning ecology» is helpful to understand the hybridization of contexts based on ICT use, integrating formal, non-formal and informal opportunities to improve lifelong learning. With the incorporation of ICT into society, multiple aspects are modified -including training and educational processes-, since it is necessary to adapt to new learning needs and give rise to permanent training. The advent of ICT questions the traditional school formats since it promotes the expansion of the areas in which knowledge is located; that is, knowledge is no longer found only in school institutions. This is why it would be interesting if current didactic proposals combine the academic and everyday world (Al-Absi and Yordzhev, 2019). The use of ICT involves a set of informal learning in the daily lives of young people, where collaboration with others is central. The ease of transporting mobile devices enables students to learn beyond the temporal and spatial limits of the educational institution. As (Eike et al., 2018) proposes, the use of ICT involves a set of informal learning in the daily lives of young people, where collaboration with others is central.

For this reason, it is no longer possible to ignore the unique learning environment that Daghestani et al. (2020) talk about: that set of their learning resources that each one uses outside the classroom, promoted mainly by mobile devices; tablets, mobile phones, notebooks, which invite learning through multiple contexts. The ease of transporting mobile devices enables students to learn beyond the temporal and spatial limits of the educational institution. This is how the authors illustrate it with examples for a better understanding: formal learning is enabled in informal contexts –for example, participating in a virtual class from the bus–, informal learning in informal contexts –for example, knowing rules of social interaction through community games– or informal learning in formal contexts, for example, doing collaborative learning in the classroom (Al-Busaidi and Al-Muharrami, 2021). Informal learning is understood as undifferentiated and subordinate to other social processes derived from people's voluntary interests. Their evaluation focuses on assessing the understanding, creativity, innovation, and progress of learners. In line with Martín and Donolo (2019), we can then express that informal learning exceeds formal and non-formal educational institutions, curricula and programs, going through people's lives in all its aspects (Aldholay et al., 2020).

### **3. Methodology**

A study related to learning ecologies, ICT, and emotions is under development based on a design methodology, which incorporates participatory experiences to improve educational practices. In order to recognize the use of networks, applications and web platforms used by a group of students, the questionnaire on digital technologies was designed (Aldholay et al., 2020).

#### *3.1. Participants*

In 2021, 63 students in the fifth and sixth years of secondary education who studied the Language and Literature curricular space in two institutions in a town in the province of Tripoli (Libya) responded to the questionnaire mentioned above. Of the participants, 26 students were in the fifth year of Orientation in Natural Sciences, and 37 were in the sixth year of Orientation in Social Sciences. The average age of the participants ranged from 16 to 18 years.

#### *3.2. Instrument*

The questionnaire on digital technologies is an instrument that is answered anonymously, created within the framework of a larger research project, to expand the knowledge about the networks, applications, and web platforms used by students and how and what do they use them. The sections and items that made up this self-administered questionnaire were selected from class observations and the available bibliography about technologies and informal learning contexts. Four specialists reviewed the questionnaire in educational psychology and educational technology to determine its validity. The instrument contains four sections in the final version, each of which includes a series of items to which the students had to answer with a cross, admitting one answer per row. In the first section, the student is asked if she has her mobile phone and, if she answers yes, what does she use it for; this is the only open-response instrument section (Ali et al., 2018).

The second section aims to know how often students use specific networks and applications. For this, a double-entry box is provided that contains a list of 23 items –for example, Pinterest, Facebook, Instagram, WhatsApp, Snapchat, Skype, Canva, Netflix, Google Drive, among others– and the frequency of use for have the student mark what they want. In the third section, 23 activities are presented for participants to answer how often they use technologies at home to solve them. Some of the activities that make up the items are "I do homework", "I participate in social networks for school homework", "I watch tutorials to learn to do something", "I listen to music", among others. Finally, the fourth section asks students to mark the level of conformity they have concerning a series of 15 statements related to carrying out activities using technologies in class. In general, the statements refer to how students carry out tasks during class - for example, "When I have to write, I prefer to do it on the computer" and their perceptions about it - for example, "The activities with technologies are easier for me "or" Technologies allow me to obtain better results in schoolwork (Al-Jabri and Al-Busaidi, 2018).

### 3.3. Procedures

The questionnaire on digital technologies was administered collectively and in print in October 2019 in two secondary education institutions. At the beginning of the selected class, the characteristics and objectives of the class, its voluntary nature, and the confidentiality of the data were explained to the participants. The average response time was 15 minutes. The data obtained from the questionnaire were analyzed with descriptive statistical procedures, such as calculations of the mean, median and standard deviation. For this, the Statistical Package for the Social Sciences software (SPSS, version 21) was used (Almansuri, 2018).

## 4. Results

The results are presented in four sections, each corresponding to a category derived from a slogan in the questionnaire on digital technologies. The categories that will be considered are general use of the mobile phone, applications, networks, use of technologies in the home, and technologies in class.

### 4.1. General Uses of Mobile Phone

The category refers to the use that participants carry out with their mobile phones and the actions they carry out using them. Of the 63 students who responded to the questionnaire, only 1.26% stated they did not have their mobile phones. This trend is consistent with what was stated by the National Institute of Statistics and Censuses about using ICT in the fourth quarter of 2018 in Libya. The institute indicates that 88.60% of people between 13- and 17-years old use mobile phones. The remaining study participants disclosed what they use their phones. At this point, it should be clarified that most of them mention more than one use. In general, the responses to the questionnaire suggest that students mainly use their mobile phones for non-school activities. The use of social networks also occupies a central place in the responses. Although we note that we have found educational uses of the networks in recent times, the expressions reflected in the questionnaire are not linked to this way of using them. To a large extent, students emphasize that they use their telephones to maintain contact with their family or friends and search for information. It is interesting to note concerning this last point that, although some students do not clarify the type of data they intend to find and for what purpose, others explain that they do it to keep up to date with current news. This last case is perceived exclusively in the participants who are in the sixth year of the branch of Social Sciences.

Another non-school use of the mobile phone that the participants regularly mention is entertainment through listening to music, reading, watching series or movies, and playing video games. Finally, to a lesser extent, students link the use of the telephone with school activities, without going too deep and expressing themselves globally by saying, for example, "to carry out school activities. Following the analysis, research carried out with Arabic students warned about the use of personal telephone mainly for instant messaging (81.70%), access to social networks (77.50%), music consumption (65, 20%) and the use of games (52.20%). In Libya, the trend towards communication is maintained since a study with young Libyan with an average age of 20 has shown that more than 80% of the participants consider it very important to use WhatsApp to communicate with their family and friends. Also, with distance secondary education students in a rural context in Libya, the importance of maintaining interactions and affective bonds through various networks and applications, such as Google Classroom, Facebook, and WhatsApp. In this section, it has been possible to glimpse how technologies affect students' daily lives in their different dimensions (linked to academics or not) and in the various contexts in which they interact, such as home or school. We cannot forget that learning and interactions occur in all these environments and activities, some more formal and others more informal. Still, all of them are the basis for lifelong learning. The responses to the questionnaire suggest that students mainly use their mobile phones for non-school activities.

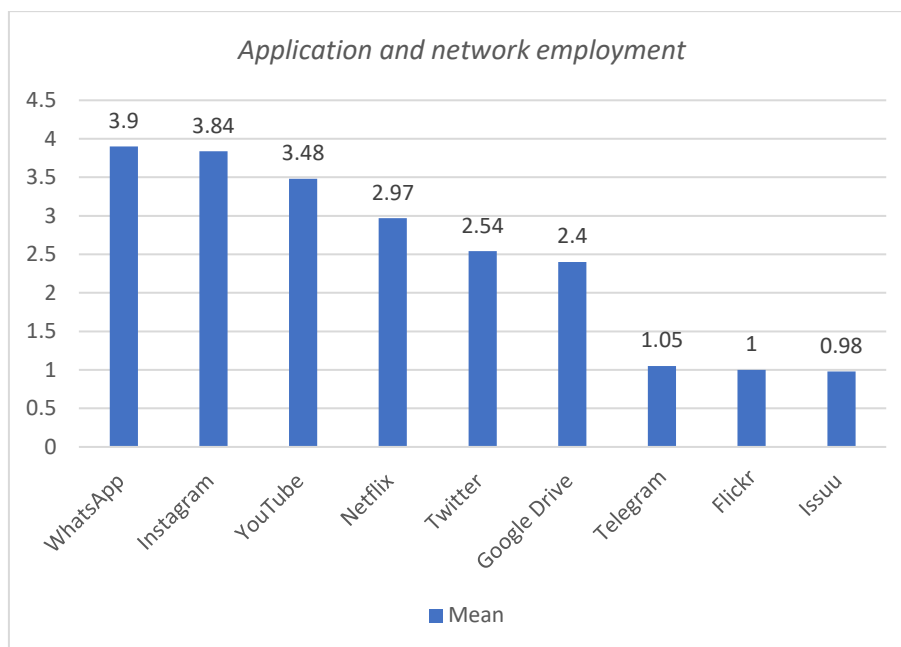
### 4.2. Using applications and networks

This section aims to enumerate the social networks, applications, and web pages most used by the participants and use less frequently. Table 1 below shows the main results obtained in this regard. Subsequently, in Figure 1, it is more clearly visualized the networks, applications and web pages most and least used by students. As can be seen that the participating group (N = 63) uses WhatsApp (M = 3.90), Instagram (M = 3.84) and YouTube (M = 3.48) with a high frequency. These values allow us to understand that these applications are widely used –between 3 and 6 days a week– and that some

students use them every day (especially WhatsApp). As can be seen that the participating group (N = 63) uses WhatsApp (M = 3.90), Instagram (M = 3.84) and YouTube (M = 3.48) with a wide frequency. These values allow us to understand that these applications are widely used –between 3 and 6 days a week– and that some students use them every day (especially WhatsApp) (Bin-Hady and Al-Tamimi, 2021).

Table 1: Mean and standard deviation of application and network employment

Applications and networks	Mean	Standard deviation
WhatsApp	3,90	0,46
Instagram	3,84	0,44
YouTube	3,48	0,73
Netflix	2,97	1,09
Twitter	2,54	1,36
Google Drive	2,40	1
Telegram	1,05	0,37
Flickr	1	0
Issuu	0,98	0,33



On the other hand, according to the responses of the participants, Telegram (M = 1.05), Flickr (M = 1) and Issuu (M = 0.98) are less frequently used and even in several cases, they are not used in any situation. If we analyze the most used applications, we find a messaging service, a social network, and a video website. WhatsApp is a viral messaging application with excellent adhesion from the study participants, unlike Telegram - another messaging service that tends not to be used. Although both applications allow sending text and multimedia messages - videos, images, and audio - and making video calls, the main difference between the two resides in the possibility that Telegram offers to send secret messages. The second most frequently used application by students is Instagram, a social network whose main objective is to share photos and videos with followers. Instagram has in common with Flickr - one of the least used - the predominance of the image, although the latter application has more possibilities for image editing. It is important to note that, although both applications are free, the free Flickr version has several limitations and lower quality. The third most used application by the participating group is YouTube, a website that allows you to share and view various types and durations.

It is interesting to note that both WhatsApp and Instagram, and YouTube are available for download on the mobile phone in Arabic and are free to use. However, the video website also has its paid option. The application least used by the study participants consists of a web page that allows you to view digitized materials, such as books, magazines, or newspapers, without having to download the document. Based on the results obtained, we tend to think that it would not be the website that students prefer to search for the information mentioned in the previous section. In an intermediate position, according to the students' responses, we find Netflix (M = 2.97), Twitter (M = 2.54) and Google Drive (M = 2.40) as those applications and websites that some would use Days of the week. Again, we find consistency with the previous results.

The first two are applications for entertainment and social networks, respectively; For its part; Google Drive would correspond to the website for educational use that students use most frequently (between 2 and 3 days a week).

A fundamental reason to use online platforms and social networks is to maintain communication with family, friends, and the world around them. In general, the most used applications coincide with the results found by Ali et al. (2018), to who investigated with students between 11 and 20 years old. In this study, it was determined that the technologies used most frequently by the participants were WhatsApp (77.10%), social networks (70.10%) and applications to listen to music (66.60%). Based on what has been expressed so far, we could think, according to (Clark and Kaw, 2020), that a fundamental reason to use online platforms and social networks is to maintain communication with family, friends and the world that surrounds us.

#### 4.3. Use of Technologies at Home

This section presents the results obtained in the third section of the questionnaire on digital technologies, which aimed to determine how often students used technologies at home to carry out a series of activities. Table 2 presents the main results. When analyzing the scores that this group of students (N = 63) obtained in section 3 of the questionnaire, it is possible to visualize two fundamental activities for which the participants use technologies at home: listening to music (M = 3.75) and communicate by mobile phone with colleagues (M = 3.38). The two scores obtained indicate that both tasks would be performed with technologies frequently, almost every day; In other words, most participants use technologies in their homes to develop activities related to what was analyzed in the previous sections. This implies carrying out tasks related to two of the most frequently used applications of WhatsApp and YouTube and the primary uses of mobile phones mentioned by the students in the first section of the questionnaire, communication and entertainment. On the contrary, the study participants express, on very few occasions, that they never use technology in their homes to carry out activities such as calculating with Excel (M = 1.13). In some cases, participants expressed that they neither participate in blogs and forums (M = 1.19) nor use specific applications for each subject (M = 1.56).

Table 2: Mean and standard deviation of the use of technologies in the home

Activities	Mean	Standard deviation
I listen to music.	3,75	0,62
I communicate by mobile phone with my classmates.	3,38	0,85
I participate in the production of tasks or jobs through shared documents.	2,54	0,71
I watch tutorials to learn how to do something.	2,33	1,03
I look for recipes.	2,05	0,99
I use specific applications for each subject.	1,56	0,79
I participate in blogs or forums.	1,19	0,61
I do calculations with Excel.	1,13	0,42

This section allows us to understand that, in general, the uses of technologies that students carry out at home would not be directly linked to academic activities but mainly to communication and recreation tasks. In this sense, a study carried out with second-year high school students about the potential of Instagram for teaching in Biology showed the initial surprise of the participants when using a social network for educational purposes and the expectation for its use as a didactic resource. As we can perceive, there are still distances and discontinuities between learning within and outside of school, including the resources used, the cognitive tools that are put into practice, and the type of performance prioritized individual or collectively others aspects (Daghestani et al., 2020).

#### 4.4. Use of Technologies in Classes

This section presents the results related to the level of conformity that students provide concerning a series of statements about using technologies in class. This category derives from the data obtained in the fourth section of the questionnaire on digital technologies, whose items respond to five dimensions of using technologies: academic, cognitive, affective, social, and technical. Table 3 is presented below, which contains the main results. In line with what is presented in table 3, the results show that the participants (N = 63) agree with three statements regarding the use of technologies in the classes: they like to take their mobile phones to school (M = 4, 78), when they need to search for information, the first resort to technology (M = 4.62) and, at the time of writing, they prefer to do it on the computer (M = 4.16). These last two statements, linked to a cognitive dimension, show us the students' priorities in the possibility of choosing different ways of carrying out a school task, be it searching for information or writing. We also find a correlation with a study carried out with university students from Tripoli, who use the internet as their first option to search for information and not the physical library.

Table 3: Mean and standard deviation of the use of technologies in the classes

Activities	Mean	Standard deviation
I like to bring my cell phone to school.	4,78	0,45
When I need to search for information, I turn to technology first.	4,62	0,55
Technologies allow me to do my work more creatively.	4,19	1,04
When I have to write, I prefer to do it on the computer.	4,16	1,03
Activities with technologies are easier for me.	4,13	1,02
Technologies allow me to obtain better results in schoolwork.	4,08	0,78
Technology activities are more fun for me.	3,81	0,91
I think that I work better in a group if we use technology.	3,75	1,10
I am more interested in activities that include technologies.	3,71	1,05
I find the study easier when I use technology.	3,60	1,35
I like to read from my mobile phone, computer, or tablet.	3,37	1,31
In most language classes, we use technology.	3,27	0,97
In class, I learn to use new technologies or applications.	3,03	1,06
When we use technology, the teacher explains how it works.	2,97	1,17
It makes me nervous about working with technologies.	1,49	0,80

On the contrary, the level of agreement of the participants with the statement related to feeling nervous at the time of working with technologies is low ( $M = 1.49$ ), which would allow us to think that these students do not experience this type of emotional state negative when working with ICT. Other items of the questionnaire that refer to the affective dimension when carrying out activities with technologies would indicate a similar trend by showing that the participants perceive the actions that use ICT as fun ( $M = 3.81$ ). They also have a great interest in tasks that involve these types of resources ( $M = 3.71$ ). And, as was made explicit in the previous paragraph, they like to take their mobile phone to school ( $M = 4.78$ ). Acquiring intermediate values, we find statements related to learning to use new technologies in class ( $M = 3.03$ ) and that, when using technologies, the teacher explains how it works ( $M = 2.97$ ). Perhaps we could think, based on these items of cognitive and technical dimensions, respectively, that in the Language and Literature classes that made up the study, completely new ICTs would not have been used for the students or that they would have required an explicit demonstration of their use (Essila et al., 2020).

With slightly higher scores, but without reaching a complete agreement on the part of the students, there are two statements linked to the academic and social dimensions that recognize that the use of technologies would improve the results of schoolwork ( $M = 4.08$ ) and group work ( $M = 3.75$ ). This section of the study allows us to understand how the limits between formal and non-formal learning are being diluted since the participants come to class with the baggage of previous knowledge related to manipulating technologies, digital information search strategies, and putting them at stake in homework.(Fahrenbach and Luomi-Messerer, 2021).

## 5. Discussion and Conclusion

In a general way, we can express that the questionnaire on digital technologies provided results that allowed us to deepen our knowledge about applications, web platforms, social networks, and technologies that this group of students use daily, both inside and outside the school institution. The results found in this sense make it possible to glimpse the wide presence that ICT currently has in the study participants' daily activities, where learning is a central aspect. The results found to make it possible to glimpse the wide presence that ICT currently has in the study participants' daily activities, where learning is a central aspect. We found a generalized use of the mobile phone in most students, mainly to communicate, entertain themselves and participate in social networks (Fahrenbach et al., 2020).

Thus, we find a generalized use of the mobile phone in most students, mainly to communicate, entertain and participate in social networks. These ways of using the mobile device coincide with those applications that are used as a priority and with the activities carried out in the homes supported by technologies: WhatsApp, to communicate with schoolmates; Instagram, as one of the preferred social networks; and YouTube, as an option to listen to music. Specifically, technology becomes relevant in the school environment as the first option for students to search for information and write. Of course, they also find specific uses in each student according to their interests to shape their learning trajectories. Here, it is interesting to note that the most used applications are linked to students' uses of technologies at home, so we could think that the mobile device is not used with great frequency in the classes analyzed (Fusheini and Salia, 2021).

These personal learning environments are formed around three types of tools. One of them is the relationship with others, and, in this study, we mainly find WhatsApp and Instagram as messaging and social network applications, respectively.

Another tool around which personal learning environments are configured is creating and editing information, such as using ICT at home to carry out tasks through shared documents. Finally, this group can detect the information access tool by searching for information on the publication or video sites, such as YouTube. As we can understand, these tools are socially shared and linked to concrete life situations. Our results are consistent with what was detected by (Al-Absi and Yordzhev, 2019) to elaborate more on the study. Since mobile devices make it possible to use various applications, networks and technologies would help students promote their continuous learning and develop their learning ecologies. In this way, technology becomes a central aspect of "ecologies" by blurring boundaries between formal and informal learning contexts (Geeraerts et al., 2018).

Technology becomes a central aspect of «ecologies» by blurring boundaries between formal and informal learning and contexts. We consider that the contribution of this work is aimed at understanding that technologies are present in the daily life of the participants and its multiple aspects: communication, entertainment, information search, academic tasks, recognizing that learning is being built in all these activities. For this reason, throughout the study, we highlighted the fuzzy boundaries we found between leisure and work, learning inside and outside the school and even among the participants. In line with what was proposed by (Andersson and Grönlund, 2019), students primarily use technologies to communicate and to use social networks, but not necessarily as a learning resource (Gerards et al., 2020).

We believe it is necessary to continue research and analyze the interaction between informal environments and school institutions. In this sense, this study warns about the need to link the extracurricular interests of students with formal education, and, at this point, it is where we consider it interesting to encourage the realization of design studies that contemplate these aspects, creating a didactic proposal together with the teachers to carry out in the classes.

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