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Student connectivity as an element of their learning ecosystem during the pandemic: Case study Universidad Pedagógica Veracruzana

Conectividad de alumnos como elemento de su ecosistema de aprendizaje durante la pandemia: Estudio de caso Universidad Pedagógica Veracruzana

Conectividade dos estudantes como um elemento do seu ecossistema de aprendizagem durante a pandemia: Estudo de caso Universidad Pedagógica Veracruzana

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ABSTRACT. The present investigation allowed us to know the internet connectivity of the 3035 students of the Bachelor of Basic Education at the Universidad Pedagógica Veracruzana during the pandemic through a virtual survey carried out in the second semester of the 2020-2021 school year to all regional centers to identify the availability of this service by region, semester, sex and age range. The study was justified by the relevance of the university's public policies to continue distance academic activities during confinement during their teacher training. A quantitative approach was used with a descriptive, non-experimental scope. The levels of analysis of the information collected in the survey at the state level were limited to the Internet connection that existed in the community where the students were; the internet service they had at home; and the computer equipment with which they carried out their school activities. The results obtained allowed us to know that most of the students had an internet connection in their community and at home to carry out their school activities during confinement, facing teaching trends through learning ecosystems to achieve Education 4.0; Almost half of all of them had their own desktop or laptop

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computer, but a similar percentage worked with their cell phones, and the rest carried out their tasks with a borrowed device. It is concluded that, in general, the digital ecosystem of LEB students was characterized by having basic elements for their initial distance teaching training during the pandemic. However, technological and teaching support opportunities were pointed out that would offer them improvements in the said ecosystem and environment during their school career.

PALABRAS CLAVE

diversificación de la educación, ecosistema de aprendizaje, formación de docentes, TIC.

RESUMEN. La presente investigación permitió conocer la conectividad a internet de los 3035 alumnos de la Licenciatura en Educación Básica en la Universidad Pedagógica Veracruzana durante la pandemia, mediante una encuesta virtual realizada en el segundo semestre del ciclo escolar 2020-2021 a todos los centros regionales para identificar la disponibilidad de ese servicio por región, semestre, sexo y rango de edad. El estudio se justificó por la relevancia de las políticas públicas de la universidad para dar continuidad a las actividades académicas a distancia durante el confinamiento durante su formación docente. Se empleó un enfoque cuantitativo, con un alcance descriptivo, no experimental. Los niveles de análisis de la información recabada en la encuesta a nivel estatal se delimitaron a la conexión a internet que existía en la comunidad donde se encontraban los alumnos; el servicio de internet que tenían en casa; y el equipo de cómputo con el que realizaban sus actividades escolares. Los resultados obtenidos permitieron conocer que la mayoría de los alumnos contaron con una conexión a internet en su comunidad y en su hogar para realizar sus actividades escolares durante el confinamiento enfrentando las tendencias de enseñanza a través de ecosistemas de aprendizaje para alcanzar la Educación 4.0; casi la mitad de todos ellos tuvieron computadora de escritorio o laptop propia, pero un porcentaje similar trabajó con su celular y el resto realizó sus tareas con un dispositivo prestado. Se concluye que, en general, el ecosistema digital de los alumnos de la LEB se caracterizó por poseer elementos básicos para su formación inicial docente a distancia durante la pandemia, aunque se señalaron oportunidades tecnológicas y de apoyo a la enseñanza que les ofrecerían mejoras en dicho entorno durante su trayectoria escolar.

PALAVRAS-CHAVE

diversificação da educação, ecossistema de aprendizagem, formação de professores, TIC.

RESUMO. A presente investigação permitiu conhecer a conectividade à internet dos 3035 alunos do Bacharelado em Educação Básica da Universidade Pedagógica Veracruzana durante a pandemia, por meio de uma pesquisa virtual realizada no segundo semestre do ano letivo 2020-2021 a todos os centros regionais para identificar a disponibilidade desse serviço por região, semestre, sexo e faixa etária. O estudo justificou-se pela relevância das políticas públicas da universidade para dar continuidade às atividades acadêmicas a distância durante o confinamento durante sua formação docente. Utilizou-se abordagem quantitativa, com escopo descritivo, não experimental. Os níveis de análise das informações coletadas na pesquisa em nível estadual se limitaram à conexão com a Internet existente na comunidade onde os alunos estavam; o serviço de internet que tinham em casa; e os equipamentos de informática com os quais realizavam suas atividades escolares. Os resultados obtidos permitiram saber que a maioria dos alunos tinha conexão com a internet em sua comunidade e em casa para realizar suas atividades escolares durante o confinamento, enfrentando tendências de ensino por meio de ecossistemas de aprendizagem para alcançar a Educação 4.0; quase metade deles tinha seu próprio computador desktop ou laptop, mas uma porcentagem semelhante trabalhava com o celular e o restante realizava suas tarefas com um aparelho emprestado. Conclui-se que, em geral, o ecossistema digital dos alunos do LEB se caracterizou por possuir elementos básicos para sua formação inicial de ensino a distância durante a pandemia, embora tenham sido apontadas oportunidades de apoio tecnológico e pedagógico que lhes oferecessem melhorias no referido ecossistema. sua carreira escolar.

1. INTRODUCTION

The COVID-19 pandemic has highlighted that the new generations of teachers require a new type of education to face the challenges of connectivity, distance education, and access to large volumes of information for their future pedagogical mediation. That is why teacher training institutions have to know, among other things, the connectivity conditions in which their students' study.

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Initial teacher training is understood as the initial preparation of teachers who attend basic education and secondary education (Vaillant, 2013, p. 187), and one of its limitations in Latin America, as Vaillant (2013) explains, is that "existing teacher training opportunities have a limited impact on classroom practices" (p.194), this is identified in the evaluations, not only of teachers but also of students in international tests, as revealed by the Program for the OECD International Student Assessment (PISA), where it explains that in 2018 Mexican students scored low in reading, mathematics, and science (OECD, 2018).

This brief overview of the initial training of teachers involves reviewing the use of Information and Communication Technologies (ICT) as a trigger to support their undergraduate studies and outlining new jobs involved in the digitalization of life itself and the work of teachers in practice.

During confinement, remote education in an emergency context was significantly accelerated, as detailed in various international studies. Studies such as that of Díez-Gutiérrez and Gajardo Espinoza (2020), as well as that of Expósito & Marsollier (2020), in which elements of analysis of public education policies in basic education are shown and various problems on the use of predominant pedagogical resources, in which it is noted that the use of different technologies does not mean that inequalities in access to education have been overcome. That is why the present study was carried out in a Higher Education Institution (IES) as a case study.

The institution where the research was carried out is the Veracruzana Pedagogical University (UPV), a public state university in Mexico whose primary objective is the "training of education professionals, research in educational matters, and cultural dissemination according to the needs of the country." (Official State Gazette, 1980). The UPV, whose objectives are established in its decree:

> 1. To train human resources of the highest level in basic education; 2. Participate in research and fields of knowledge that contribute to education; 3. Strengthen Education through the training of specialized teachers; 4. Participate in the development of the community through programs that spread scientific knowledge and art; and 5. Persevere, increase and spread the national and universal culture. (Official State Gazette, 1980).

This HEI serves 3,610 students in two bachelor's degrees, one specialty, six diplomas, four master's degrees and a doctorate in 15 Regional Centers (CR) throughout the state of Veracruz (Government of the State of Veracruz, 2018). For the attention of school activities, the RC of the UPV is located in: Pánuco, Tantoyuca, Naranjos, Tuxpan, Papantla, Martínez de la Torre, Xalapa, Coatepec, Veracruz, Córdoba, Orizaba, Ciudad Mendoza, Cosamaloapan, San Andrés Tuxtla and Minatitlán (Veracruz Secretary of Education, 2020).

The social function of the UPV implies that classes are taught on Saturdays in person (until before the COVID-19 pandemic) where the RCs operate, installed mainly in primary education schools that are not used at those times. This range of opportunities for professionalization and updating of teachers in Veracruz has made it possible to serve more than 25,000 teachers throughout its existence (Ordoñez López, 2018, p.110), not counting those that are currently in process.

The UPV has an educational model called Horizonte Educativo (Velasco Toro et al., 2016), which involves a pedagogical mediation that invites to "develop divergent thinking […] essential in the process of learning in learning, which helps to move from the absence to the emergence of an effective, permanent behavior" (p. 139). Thus, this horizon is based on this complex process, whose thesis establishes that for the initial training of

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teachers, it is necessary to incorporate elements such as self-organization, autonomy, creativity, communication, language, intersubjectivity (collaborative work), ethics, interculturality and Information and Communication Technologies (pp. 91-117).

Three documents were made available within the University as a public educational policy, to address the academic emergency that resulted from social confinement (Hernández Ferrer & Valencia Aguilar, 2021, p. 3), namely: a) Academic Strategy for the attention of the students in the contingency period; b) Academic Strategy for the Undergraduate and Postgraduate study programs in the face of the COVID-19 health contingency. Phase Two; and c) Academic Strategy for the Undergraduate and Postgraduate study programs in the face of the COVID-19 Phase Two and Three health contingency.

In this academic emergency, the Internet meant an element of interaction that promotes social networks, in addition to the creation of virtual communities in various fields: work, education, and consumption. For the educational environment, the current generations of students use the web for the incorporation and interaction of virtual communities where the members coexist voluntarily to exchange and generate new knowledge in a collaborative manner (OEA-Portal, 2015, pp. 1-3). Therefore, the concept of a learning ecosystem becomes relevant from the perspective of distance education (e-learning); it is a unit composed of interdependent organisms that share the same habitat or environment. From a biological perspective, an ecosystem is a natural system made up of a set of living organisms and the physical environment in which they are related (OEA-Portal, 2015, p. 6)

As Islas Torres & Alcántar Carranza (2017) express it, a digital learning ecosystem is identified as

> a paradigm of future education systems, supported by information and communication technologies. These are characterized by being based on adaptive systems capable of being modified from different relationships or interactions given in a symmetrical sense between the components of the system: context, users, content, devices, applications, forms of communication, among others (Islas Torres & Alcántar Carranza, 2017, page 5)

Two elements of analysis stand out: a) biotics of a digital ecosystem, that is, the concept of communities: social networks of specific content, free software developers, content curators, content production and exposure communities; and, b) abiotic elements, which are understood as the infrastructure, economy, culture and legislation that serve as support for the generation and evolution of the ecosystem composed of multidimensional spaces where there are entities that mutate, in this case, the contents directed to the individuals who are responsible for consuming or producing them. (Islas Torres & Alcántar Carranza, 2017, p.5).

For the management of education, as expressed by Islas and Alcántar (2017), a digital ecosystem is based on the assumption that people choose what they learn, when and how they learn it based on their needs (times and rhythms), where Learning limitations are eliminated, based on the use of tools, the Internet and its applications, and electronic devices. Román Mendoza & Suárez-Guerrero (2021), explain that the technological elements are introduced in a non-consensual way and are made up of resources developed for undefined and homogenizing educational contexts. It should be noted that "the need for professional training related to aspects of the use and management of technologies is identified, but not in an instrumental way, but rather in a contextualized use related to didactics, group dynamics, interactions and forms of evaluation. " (Sánchez Mendiola et al., 2020, p. 16).

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From the review of the official documents issued by the Ministry of Public Education (SEP) in Mexico, published to serve the student community, these were only aimed at the basic level; The "Learn at Home" strategy was found, which was implemented by the SEP (2020) for the levels of initial, preschool, primary and secondary. Locally, the State of Veracruz, through the Secretary of Education of Veracruz (2021) in the program "Veracruz Educando a Distancia," complementary guides were published, and the official radio station of the State of Veracruz (Radio-Televisión from Veracruz). No elements were found for higher education nor for teacher training institutions. In terms of Ruiz Larraguivel (2020), university teachers "have not only found themselves in need to learn in isolation..., they are also experiencing processes of adaptation to the new situations that online education implies" (p.110), in the understanding that the effectiveness of teaching is due to social interaction.

From another perspective, Amaya et al. (2021) explain that "no national and international, public or private Higher Education Institution in face-to-face mode was immediately prepared to face a problem such as the one generated by the COVID-19 pandemic in educational matters." In addition, "content was adjusted in order to plan and organize ICT-mediated learning situations" (Soto Ortiz, 2022, p.198), which leads to identifying that the activities did not stop in this emergency process.

On the other hand, technological advances and industrial development led to the so-called Industry 4.0. Despite the fact that the changes produced in the industry affect education and therefore require its transformation towards the so-called Education 4.0, Flores Olvera et al. (2020) mention that studies and a definition of this new concept are lacking because most articles refer to industry 4.0 but do not describe the concept of Education 4.0, an educational trend that seeks to train professionals to that can adapt to the dynamics of technological advances and therefore higher education must face the "needs of this new productive approach, through the training of students who respond to the profiles that the industry requires" (Rodríguez et al., 2019, page 697).

In this context, there are learning trends that reflect the impact of Education 4.0 in higher education and especially in teacher training, as a result of advances in ICT, such as the case of e-learning, b-learning, m-learning, and u-learning, which during the pandemic have required teachers and students to acquire new digital skills that help them integrate into distance education virtually.

E-learning contemplates platforms of virtual environments that have been changing the oral training culture for a technological culture (Camacho, 2019); the b-learning approach combines online learning activities with the training given by the teacher as in "class backwards" (Bergmann & Sams, 2012); mobile learning (m-learning) occurs through different mobile devices and according to UNESCO has the potential "to transform educational opportunities and educational outcomes" (Shuler et al., 2013, p. 8) and "is it will integrate more into the ordinary educational system" (Valencia-Molina et al., 2016, p. 19). In the case of u-learning or universal education, it seeks to bring learning closer to learners' close contexts in order to achieve context-based training (Báez Pérez & Clunie Beaufond, 2019).

In short, Education 4.0 requires that future teachers in higher education use their digital skills throughout their entire career and school practice because "the best appropriation of ICTs in teaching would require the development of skills and the construction of knowledge from reflective didactics" (Valencia-Molina et al., 2016, p. 16).

With this, the present study was justified in the sense that insufficient elements were found to identify which sections were necessary to know how the students faced their studies in times of the COVID-19 pandemic, which

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leads to an academic reflection on their subsequent discussion. In addition, a technical justification is reached to deal with new contributions to the field of the discipline of the use of ICT to attend academic activities in this temporality. Regardless of the concern of the authors, in order to delve into the various theoretical and technical approaches that allow different authors to show for this theme of admission to higher education.

Based on the above, the objective of this research is to know the internet connectivity that the students of the Bachelor of Basic Education of the Universidad Pedagógica Veracruzana have during the pandemic through a virtual survey carried out in the second semester of the 2020 school year. -2021 to all regional centers to identify the availability of this service by region, semester, gender, and age range.

2. METHOD

This document was integrated as part of a long-standing investigation that is in the research area of the UPV, included in the Line of Generation and Application of Knowledge called Policies, institutions, subjects, and educational actors. From this, a space for training and critical analysis is opened around these main aspects: and from these, the field of education is constituted, namely: policies, institutions, and the subjects that inhabit them. Therefore, the three aspects that are proposed here as nodal, because they are the backbone of the field, must always be addressed in a complementary relationship and not as separate aspects from each other. This inquiry sought to interpret the school experiences of UPV learners in this temporality –for the Universidad Pedagogica Veracruzana the term learner is used based on the theoretical and curricular foundation, as well as in accordance with the constructivist perspective of the various study programs– as well as being in correspondence with the pedagogical model called Educational Horizon that refers to every person who learns in learning throughout his life.

The approach used in this research is quantitative, with a descriptive scope, not experimental. The analysis of the information was based on a fundamental element that was to obtain the data from a digital survey during the pandemic, through the Google Forms application, at the beginning of the second semester of the 2020-2021 school year (February 2021), with which Among other aspects, we sought to know the connectivity of these students during their distance studies in COVID-19. 3,035 students enrolled in all semesters of the LEB participated in the 2020-2021 school year located in the 14 regional centers where the program was offered.

The five levels of analysis of the information collected in the survey at the state level were limited to the Internet connection that existed in the community where the students were; the internet service they had at home; and the computer equipment with which they carried out their school activities; these three important aspects divided by regional center, age range, sex or semester.

Now, this is a case study for the UPV based on three criteria: the inquiry allows the study of a specific topic; a contemporary phenomenon is identified in its natural environment; and; it allows studying the latter from multiple perspectives (Martínez C., 2006). The validity is of construction due to the techniques of use of various sources of documentary information or evidence in the data collection phase (Martínez C., 2006, p.178).

It should be noted that this document serves as an element to generate and visualize an educational research process. In terms of Reimers & McGinn (2000), "the use of [educational] research not only helps decision makers to choose courses of action but to identify what their options are" (p.10).

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3. RESULTS

3.1 The connection in the community of UPV students in times of the pandemic

80% of the 3,035 LEB students who entered all UPV regional centers in the 2020-2021 school year, the period in which the first phase of the pandemic was experienced, had two types of connection in the community in particular in which they lived: urban area with internet signal (49.72%) and rural community with internet signal (30.94%). The distribution of the service in each of the regional centers is shown in Figure 1.

Figure 1

Type of Internet connection in the community of LEB students by Regional Center
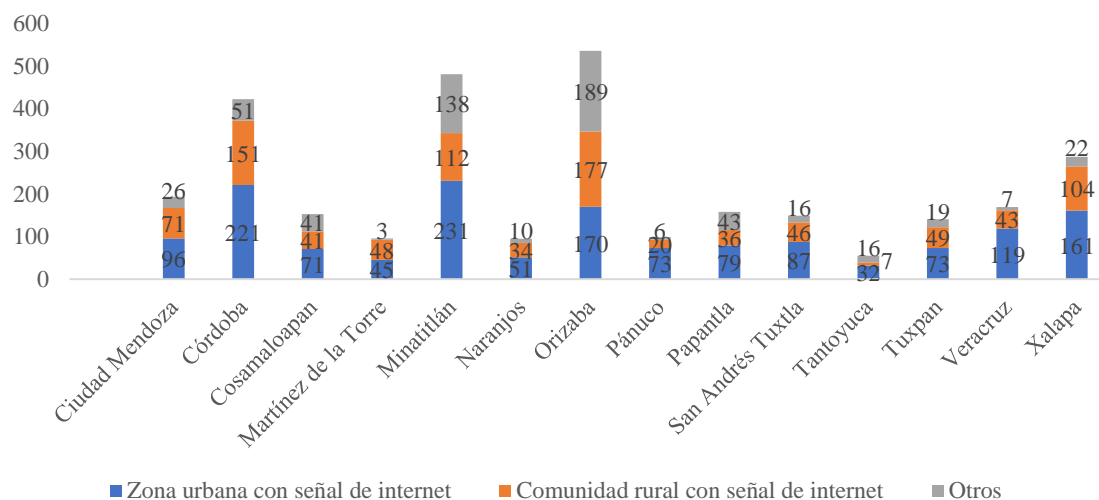
In addition, 60% of the students who lived in an urban area with an internet signal studied in only five regional centers: Córdoba, Minatitlán, Orizaba, Veracruz, and Xalapa; and 65% of those found in a rural community with an internet signal were from the regional centers of Ciudad Mendoza, Córdoba, Minatitlán, Orizaba and Xalapa. He highlighted that almost 10% of all LEB students lived in an urban, rural, or indigenous community without an internet signal.

The digital gap that still exists in some regions of Veracruz reflects the Medium-Low level of the ICT Development Index assigned to the State, created by the International Telecommunications Union, which denotes the diffusion, access, and ability to take advantage of the ICT in a region (Micheli & Valle Zárate, 2018, p. 47), taking into account that "the study of the digital divide constitutes important theoretical and methodological challenges, since there are no single models for its analysis and multiple perspectives are presented to observe it" (Gómez Navarro et al., 2018)

3.2 Internet connection at home by age range

At home, 75% of students across the state had an Internet connection, almost the other 25% had to go to a family member's, friend's or Internet cafe to be able to connect, and only six students could not connect to online classes (less than 1%), as can be seen in Figure 2.

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Figure 2

Internet connection at home by age range of LEB students
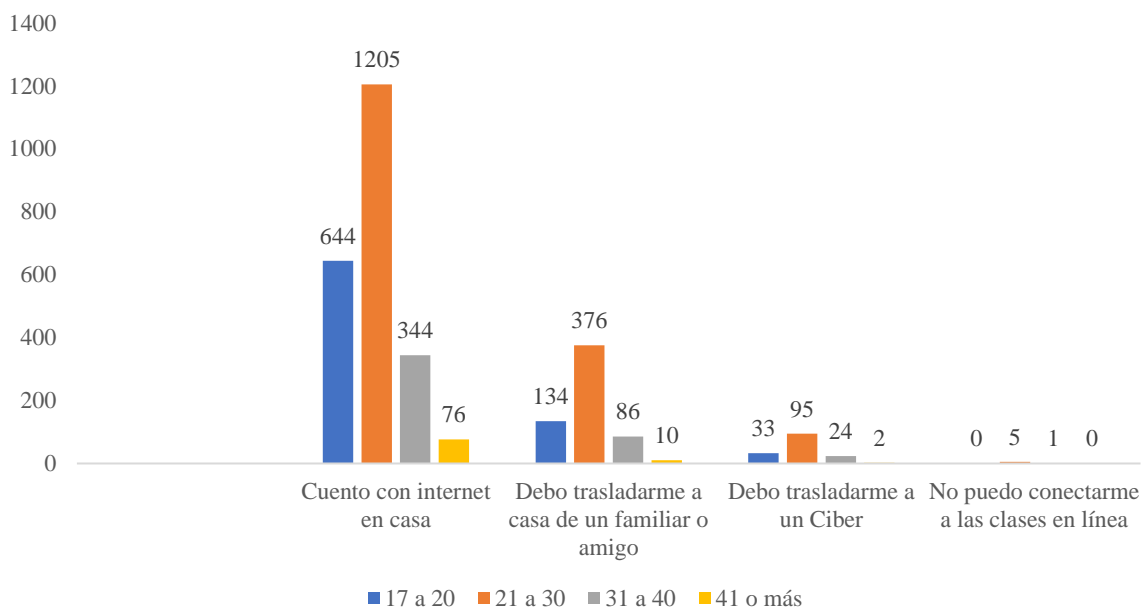
55% of the students were between 21 and 30 years old, another 25% were under 21 years old and the rest (18%) were over 30 years old. The highest frequency with internet connection at home was presented with 1205 students between 21 and 30 years old. It is important to point out that 82% of LEB students were under 31 years of age.

Despite the difficulties of some of the students to have connectivity, "Internet access in Mexico had an upward trend... In the last... years, availability in Mexican homes has been increasing, approximately 4% per year" (Martínez-Domínguez, 2020), since the internet "converges with the right to information because as a technological and communicative means it allows the individual to form oriented opinions (inform themselves), participate in the process of exchange and debate (communicate) and collaborate with collective growth (training)" (Alcalá Casillas, 2019).

3.3 Computer equipment they had at home by gender

Regarding the computer equipment they had at home for their school activities, 47% of the students had their own desktop or laptop computer. However, it stands out that another 44% of the total number of students worked with their cell phones and that almost another 7% did their homework with a borrowed computer or laptop. Graph 3 shows that 78% of enrolled students were women and 22% men. 90% of women and 92% of men used a computer, their own laptop or cell phone.

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Figure 3

*Computer equipment that LEB students had at home*
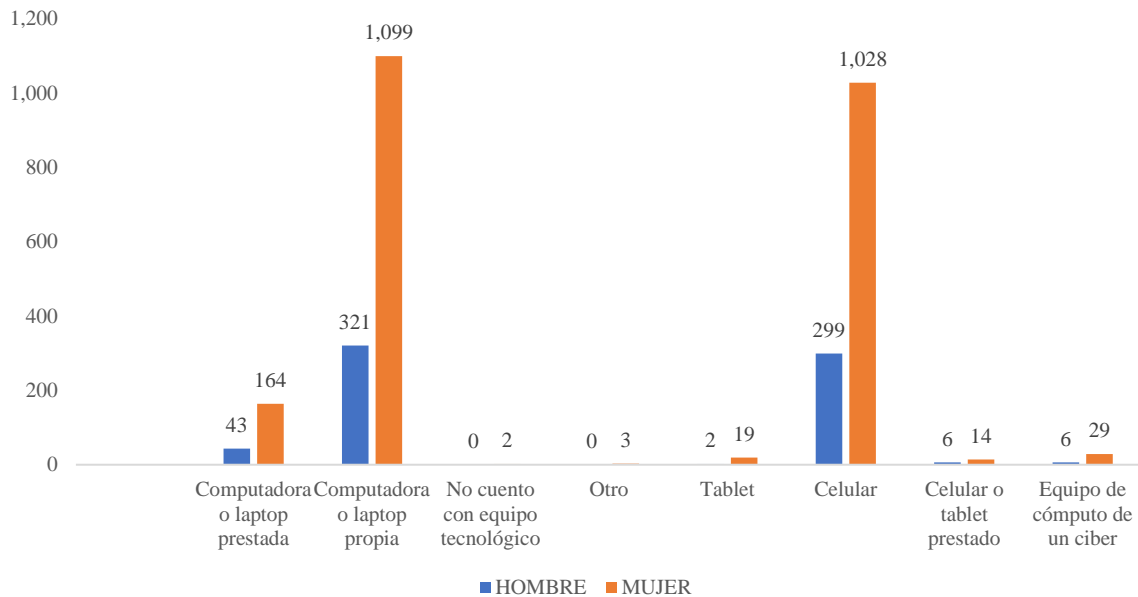
It is important to mention that "moving learning from classrooms to homes on a large scale and in an accelerated manner has presented enormous challenges, both human and technical" (Gervacio Jiménez & Castillo Elías, 2021), which is why teacher training institutions face the challenge that "this must be inseparable from the so-called 'leaving no one behind', which implies… generating the conditions for teachers and students to have the required access to digital media" (Martínez Márquez, 2021).

3.4 Computer equipment they had at home by regional center

The five regional centers that had the largest number of students with their own desktop or laptop computer were Córdoba, Minatitlán, Orizaba, Veracruz and Xalapa; and Ciudad Mendoza, Córdoba, Minatitlán, Orizaba and Xalapa had the highest number of students who worked with their cell phones (see Figure 4).

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Figure 4

Computer equipment of LEB students by Regional Center
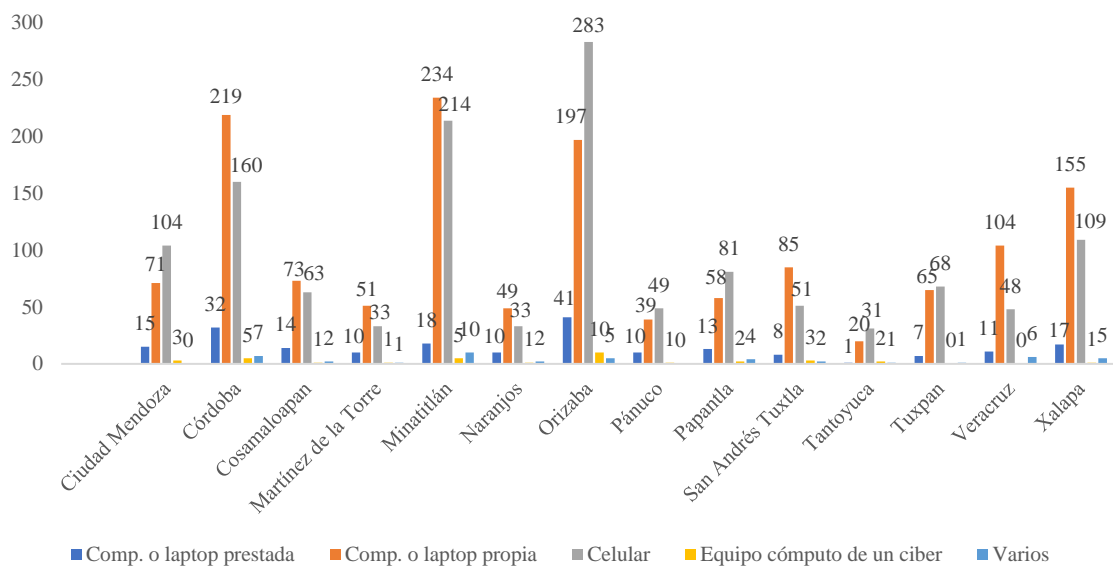
The use of mobile devices such as cell phones is a constant in the survey, taking into account that "the democratization of mobile devices has been a concern for developing countries, since it is an indispensable means for economic, social and educational dynamics. (Easter-Rengifo et al., 2020). This is explained because the generations of students in the digital age have these devices as educational reinforcements, whose "applications have the characteristics of keeping you connected to the virtual world, boosting creativity, lightening work, staying connected, providing entertainment and simplifying above all access to information" (Cárdenas García & Cáceres Mesa, 2019).

3.5 Internet service that students had in each semester

The connection that the students of the different semesters who studied the LEB had at home was diverse. The highest percentage of students (37%) was enrolled in the fourth semester, of which 70% had internet at home and almost 25% had to go to a friend's or relative's house to connect. The behavior was similar for students in the second, sixth and eighth semesters, as can be seen in Figure 5.

As can be seen, it is essential that students have internet service, an important challenge for higher education institutions and especially teacher trainers, who must provide an educational response to new technological requirements "for the training of digitally autonomous professionals that permanently update their knowledge and skills to meet current and future needs" (Hernández-Orellana et al., 2021), experiencing a complex situation that depending on the "experience accumulated by universities in the use of the virtual modality, some have responded better than others to the challenge faced" (Molina Gutiérrez et al., 2021).

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Figure 5

Internet service available to LEB students per semester
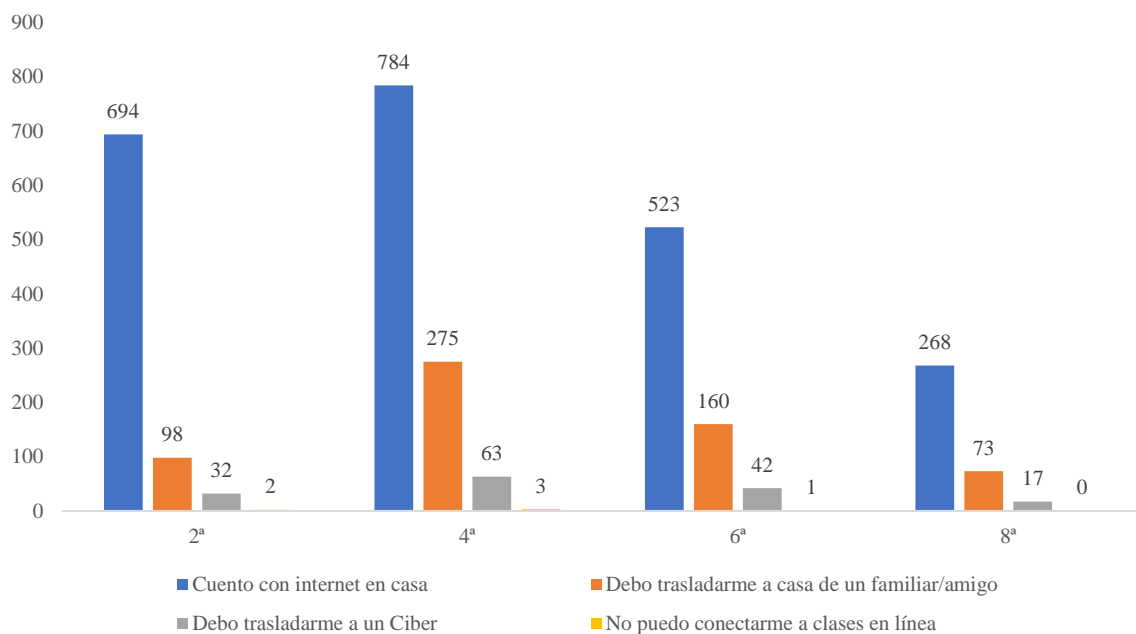
4. DISCUSSION

Although it is true, the UPV does not have its own physical facilities due to the social function with which it was created (Valencia Aguilar, 2018, pp. 265-266), students are served in facilities provided by other educational levels. As Ordoñez López (2018) expressed it, the UPV has trained more than 25,000 teachers since its foundation, highlighting that this HEI has carried out this vital task in person. However, at the time of the COVID-19 pandemic, remote education involved making use of various tools to continue academic activities.

The UPV implemented elements of educational public policy to open up the use of ICTs, synchronously (video calls, calls by cell phone or telephone) as well as asynchronously (email and the use of virtual learning environments as information repositories). But it was important to identify elements such as the internet connectivity that the students had, the type of connection, and the computer equipment with which they carried out their academic activities, especially to show how the students of the UPV have developed skills to use a digital ecosystem that allowed them to learn according to their academic needs.

Although it is true, the use of ICT must be adjusted as a tool for specific areas of education, where information is transformed into knowledge and allows the generation of learning networks (teachers and students), it implies making the change from ICT to Learning and Knowledge Technologies (TAC) oriented to teaching (Luna Rizo & Ramos Zepeda, 2017, pp. 181-188).

Through the collection instrument, it was possible to identify that learners may have the possibility of accessing Education 4.0 since they have the tools to adapt to the dynamics of technological advances for educational development, as expressed by Flores Olvera et al. (2020). Not only because of having the equipment and connectivity, but it is also about the use of e-learning through which UPV learners self-manage their learning with the support of pedagogical mediators (teachers) and their peers through applications such as Edmodo and

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Google Classroom, among others. In terms of Camacho T. (2019), a "technological culture is incorporated gradually in exchange for oral training culture" (p. 337).

We cannot fail to mention Bergmann & Sams (2012), pioneers in the implementation of the "reverse class", since this study highlights that the UPV has a high possibility of integrating said model in the LEB, incorporating in a way gradually these elements of improvement because the learners showed in the results that to achieve their goal of advancing in their academic activities they must have connectivity, as well as the appropriate equipment.

It should be noted that one of the discussions in this work focuses on m-learning, as an educational strategy, by returning to Shuler et al. (2013), who expressed that mobile learning has the potential to transform educational opportunities and, consequently, the results of education. Here a window of opportunity for new studies is mentioned: generate an appropriate application to the initial teacher training offered by the UPV, both for academic activities within the university and in the various actions carried out by learners when doing internships, in primary education schools.

What cannot be questioned is that this investigation showed that through ubiquitous education, learning is brought closer to the close contexts of the learners, with the aim of achieving a training based on inclusion, fully complying with what mentioned by Báez Pérez & Clunie Beaufond (2019), when they point out that by making use of the correct applications (asynchronous communication) learning is motivated at any time and in any place.

5. CONCLUSIONS

Teacher training institutions must carry out actions to favor the learning ecosystem of the students they serve, and for this, they have to know, among other things, the connectivity they have to receive their distance education virtually. The UPV undertook this task in the midst of a pandemic, and this study accounts for it and contributes to discovering relevant characteristics of this area.

The results obtained allow us to know that the majority of the students of the regional centers who studied the Bachelor of Basic Education of the UPV during the 2020-2021 school year had an internet connection in their community and at home to carry out their school activities. During confinement to face the learning trends demanded by Education 4.0. In addition, almost half of all of them had their own desktop or laptop computer, but a similar percentage worked with their cell phones, and the rest carried out their tasks with a borrowed computer or laptop. From this, a new investigation can be carried out to promote the design of activities that are more flexible in the use of mobile devices during the LEB training experiences, that is, the implementation of u-learning.

Another trigger element to address is that the UPV could promote additional research among the academic community in order to identify at the beginning of each school year the LEB students who have to go to a cyber, who do not have a computer or laptop, or that they do not have internet connectivity to carry out their school activities, in order to outline institutional strategies to support teaching that help them reduce the digital gap that they live in each regional center of the UPV; that is, combine or differentiate the elements of learning ecosystems (biotic elements) and visualize that the initial training of teachers at the UPV can aspire to create specific elements of Education 4.0, in accordance with the Educational Horizon of the UPV for intensive use of ICT.

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Oscar Valencia: Conceptualización, análisis formal, investigación, metodología, administración del proyecto, escritura -preparación del borrador original, escritura -revisar & amp; edición.

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REFERENCES

Alcalá Casillas, M. G. (2019). Desigualdad en el acceso a internet en México y la afectación en el ejercicio del derecho humano a la información. Nuevo Derecho, 15(24), 55–70. https://doi.org/10.25057/2500672x.1122

Amaya, A., Cantú Cervantes, D., & Marreros Vázquez, J. G. (2021). Análisis de las competencias didácticas virtuales en la impartición de clases universitarias en línea, durante contingencia del COVID-19. Revista de Educación a Distancia (RED), 21(65). https://doi.org/10.6018/red.426371

Báez Pérez, C. I., & Clunie Beaufond, C. E. (2019). Una mirada a la Educación Ubicua. RIED. Revista Iberoamericana de Educación a Distancia, 22(1), 325. https://doi.org/10.5944/ried.22.1.22422

Bergmann, J., & Sams, A. (2012). Dale la vuelta a tu clase. Lleva tu clase a cada estudiante, en cualquier momento y cualquier lugar. https://bit.ly/3Jo3Hej

Camacho T., M. A. (2019). Formación Docente a través de la Plataforma E-Learning como herramienta para el Aprendizaje Colaborativo. Revista Scientific, 4, nú, 335–345. https://www.redalyc.org/journal/5636/563659492020/html/

Cárdenas García, I., & Cáceres Mesa, M. L. (2019). Las generaciones digitales y las aplicaciones móviles como refuerzo educativo | Cárdenas García | Revista Metropolitana de Ciencias Aplicadas. Revista Metropolitana de Ciencias Digitales, 2(1), 7. http://remca.umet.edu.ec/index.php/REMCA/article/view/77/180

Expósito, E., & Marsollier, R. (2020). Virtualidad y educación en tiempos de COVID-19. Un estudio empírico en Argentina. Educación y Humanismo, 22(39), 1–22. https://doi.org/https://doi.org/10.17081/eduhum.22.39.4214

Flores Olvera, D. M., Guzmán Games, F. J., Martínez Barragán, Y. M., Ibarra Cruz, E., & Cortés, A. E. (2020). Educación 4.0, origen para su fundamentación. In Contribuciones de la tecnología digital en el desarrollo educativo y social. (pp. 165–177). Adaya Press.

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Gaceta Oficial del Estado. (1980). Decreto de Creación de la UPV. https://bit.ly/3oPe0OV

Gervacio Jiménez, H., & Castillo Elías, B. (2021). Impactos de la pandemia COVID-19 en el rendimiento escolar durante la transición a la educación virtual. Revista Pedagógica, 23, 1–29. https://doi.org/10.22196/RP.V22I0.6153

Gobierno del Estado de Veracruz. (2018). La socioeconomía de Veracruz en cifras. https://bit.ly/3OZ4Tpw

Gómez Navarro, D. A., Alvarado López, R. A., Martínez Domínguez, M., Díaz de León Castañeda, C., Gómez Navarro, D. A., Alvarado López, R. A., Martínez Domínguez, M., & Díaz de León Castañeda, C. (2018). La brecha digital: una revisión conceptual y aportaciones metodológicas para su estudio de México. Entreciencias: Diálogos En La Sociedad Del Conocimiento, 6(16), 47–62. https://doi.org/10.22201/enesl.20078064e.2018.16.62611

Gutiérrez Díez, E. J., & Gajardo Espinoza, K. (2020). Políticas Educativas en Tiempos de Coronavirus: La Confrontación Ideológica en España. Revista Internacional De Educación Para La Justicia Social, 9(3), 83–101. https://doi.org/https://doi.org/10.15366/riejs2020.9.3.005

Hernández Ferrer, E., & Valencia Aguilar, O. (2021). Cómo están pasando la pandemia los estudiantes de la Universidad Pedagógica Veracruzana: un estudio de caso. Revista Diálogos Sobre Educación. Temas Actuales En Investigación Educativa., 12(22), 1–23. https://doi.org/https://doi.org/10.32870/dse.v0i22.816

Hernández-Orellana, M. P., Pérez-Garcias, A., & Roco-Videla, Á. G. (2021). Digital identity and connectivity: knowledge and attitudes of Chilean university students. Formacion Universitaria, 14(1), 147–156. https://doi.org/10.4067/S0718-50062021000100147

Islas Torres, C., & Alcántar Carranza, M. del R. (2017). Ecosistemas digitales y su manifestación en el aprendizaje: Análisis de la literatura. Revista de Educación a Distancia (RED), 17(55), 1–13. https://doi.org/http://dx.doi.org/10.6018/red/55/9

Luna Rizo, M., & Ramos Zepeda, D. (2017). Acercamiento a las TIC y TAC en la capacitación docente. In Educar en la era digital. Docencia, tecnología y aprendizaje (1st ed., Vol. 1, pp. 181–201). Pandora.

Martínez C., P. C. (2006). El método de estudio de caso: Estrategia metodológica de la investigación científica. Pensamiento y Gestión: Revista de La División de Ciencias Administrativas de La Universidad Del Norte, 20, 165–193. https://doi.org/10.1055/s-0029-1217568

Martínez Márquez, M. A. (2021). Realidades y retos en el uso de las TIC en educación, por la emergencia sanitaria provocada por el COVID-19. Revista de Investigación En Tecnologías de La Información, 9(19), 73–88. https://doi.org/10.36825/riti.09.19.006

Martínez-Domínguez, M. (2020). Apropiación social de TIC: el caso de internet en México. Estudios Sociales. Revista de Alimentación Contemporánea y Desarrollo Regional, 30(55). https://doi.org/10.24836/es.v30i55.917

Micheli, J., & Valle Zárate, J. E. (2018). La brecha digital y la importancia de las tecnologías de la información y la comunicación en las economías regionales de México. Revista Internacional de Estadística y Geografía,

Rev. innova educ. Vol. 5. No. 1 (2023) pp. 7-22

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9(2), 1–108. https://bit.ly/3PX2ddg

Molina Gutiérrez, T. de J., Lizcano Chapeta, C. J., Álvarez Hernández, S. del R., & Camargo Martínez, T. T. (2021). Crisis estudiantil en pandemia. ¿Cómo valoran los estudiantes universitarios la educación virtual? Jurnal Aplikasi Teknologi Pangan, 4(1), 1–2. https://bit.ly/3d22HQX

OCDE. (2018). Programa para la Evaluación Internacional de Alumnos de la OCDE (PISA). PISA En Español, 1(en 2000), 15–16. https://www.oecd.org/pisa/publications/PISA2018_CN_MEX_Spanish.pdf

OEA-Portal. (2015). Ecosistemas de aprendizaje: una propuesta para abrir los ambientes de aprendizaje | Portal Educativo de las Américas. https://bit.ly/3JsJLXq

Ordoñez López, C. A. (2018). Universidad Pedagógica Veraruzana (1979-2017). Un horizonte de 38 años. Universidad Pedagógica Veracruzana.

Pascuas-Rengifo, Y. S., García-Quintero, J. A., & Mercado-Varela, M. A. (2020). Dispositivos móviles en la educación: tendencias e impacto para la innovación. Revista Politécnica, 16(31), 97–109. https://doi.org/10.33571/rpolitec.v16n31a8

Reimers, F., & McGinn, N. F. (2000). Diálogo Informado: el uso de la investigación para conformar la, política educativa. In México: Centro de Estudios Educativos. https://cutt.ly/6LYXZ3d

Rodríguez, N. A., Acosta O., A., & Dorantes H., P. M. (2019). Los retos de la educación 4.0. In E. R.-V. Sánchez & B. L. Josefina (Eds.), Edutecnología y aprendizaje 4.0 (1st ed., p. 783). Sociedad Mexicana de Computación en la Educación A.C. - UNAM. https://bit.ly/3vvBoF1

Román Mendoza, E., & Suárez-Guerrero, C. (2021). Ecosistemas locales de aprendizaje ante la globalización tecnológica. Retos de los modelos educativos digitales pospandemia. Revista Interuniversitaria de Investigación En Tecnología Educativa, 1–11. https://doi.org/10.6018/riite.503001

Ruiz Larraguivel, E. (2020). La práctica docente universitaria en ambientes de educación a distancia. Tensiones y experiencias de cambio. In Educación y Pandemia. Una visión académica (pp. 109–113). Universidad Nacional Autónoma de México, Instituto de Investigaciones sobre la Universidad y la Educación. https://bit.ly/3BCvd5G

Sánchez Mendiola, M., Martínez Hernández, A. M. del P., Torres Carrasco, R., de Agüero Servín, M., Hernández Romo, A. K., Benavides Lara, M. A., Rendón González, V. J., & Jaimes Vergara, C. A. (2020). Retos educativos durante la pandemia de COVID-19: una encuesta a profesores de la UNAM. Revista Digital Universitaria, 21(3). https://doi.org/10.22201/codeic.16076079e.2020.v21n3.a12

Secretaría de Educación de Veracruz. (2020). Universidad Pedagógica Veracruzana » Directorio de Centros Regionales. https://www.sev.gob.mx/upv/directorio-de-centros-regionales-de-estudio/

Secretaría de Educación de Veracruz. (2021). Veracruz Educando a Distancia. http://www.sev.gob.mx/educando-a-distancia/

Secretaría de Educación Pública. (2020). Aprende en casa - Materiales Educativos. https://aprendeencasa.sep.gob.mx/

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Shuler, C., Winter, N., & West, M. (2013). El futuro del aprendizaje movil. Implicaciones para la planificación y la formulación de políticas. Unesco, 1–49. http://unesdoc.unesco.org/images/0024/002429/242996s.pdf

Soto Ortiz, J. L. (2022). Apreciaciones acerca del aprendizaje a distancia en la formación de docentes de educación básica, caso UPV. In Enseñanza remota de emergencia en la educación superior: ¿Base para la educación híbrida? : Háblame de tic (pp. 195–208). Editorial Brujas. https://bit.ly/3cWVyRQ

Vaillant, D. (2013). Formación inicial del profesorado en América Latina : dilemas centrales y perspectivas. Revista Española de Educación Comparada, 0(22), 185. https://doi.org/10.5944/reec.22.2013.9329

Valencia Aguilar, O. (2018). Modelo bimodal en un programa profesionalizante de Maestria en Educacion Basica: implementacion y primeros impactos. In Políticas públicas y politicidad en educación. Configuraciones teóricas e investigación (1st ed., pp. 264–282). Universidad Pedagógica Veracruzana. https://cutt.ly/6LYXTuN

Valencia-Molina, T., Serna-Collazos, A., Ochoa-Angrino, S., Caicedo-Tamayo, A. M., Montes-González, J. A., & Chávez-Vescance, J. D. (2016). Competencias y estándares TIC desde la dimensión pedagógica una perspectiva desde los niveles de apropiación de las TIC en la práctiva educativa docente. Pontifica Universidad Javeriana de Cali, 77. https://bit.ly/3PU6TAL

Velasco Toro, J. M., Peredo Carmona, P. B., Fuentes Navarro, F., González Cajica, M. G., & López Callejas, M. (2016). Horizonte Educativo. Hacia una pedagogía de la autoorganización. https://cutt.ly/iLYXHw3

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