Digital skills gap: Industry demand vs. Higher Education Institutions offerings

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Abstract. *The digital era has brought about the automation of the past routine tasks, as well as the development of soft skills such as problem solving or creativity. Every citizen is now required to handle basic digital knowledge to fully participate and live in modern society.*

In this context, a fundamental question arises: What do digital skills mean and how is it different from digital competence or digital literacy? Are universities training students properly so that they can achieve the level of digital skills that will be demanded in their future workplaces? Is there a gap between the companies' expectations and the graduates' abilities in terms of digitalization?

The responses point out that although mastery of basic automation tools is an essential requirement in any job description (e.g., advanced Excel), the use of more specific tools (transactional tools such as SAP, Salesforce, Power BI, etc.) is closely linked to the type of business and sector. For this reason, the focus should be placed not so much on the ability to execute digital tools but instead on the development of specific soft skills.

Keywords. Education, employment, digital skills, gap

1 Introduction

Every citizen is now required to handle basic digital knowledge to fully participate and live in modern society (Spante, 2018; Mattar et al., 2022; Zhao et al., 2021). The European Commission is fully aware of this call and because of that is actively trying to find ways to motivate the digitalization among its citizens to increase European competitiveness. The action of the European Commission can be classified into three main categories including investigation, funding, and education (Lopez-Meneses et al. 2020).

Many articles have been published regarding this area of knowledge (Crawford-Visbal, 2020; Guzman-Simon et al., 2017; Handley, 2018; Kim et al., 2018); however, this topic has not been approached from an enterprise point of view (Zhao et al., 2021). Instead, most of the articles focus on the university side and how can teachers improve when it comes to their digital preparation (Mengual-Andrés, 2016; Jiménez-Cortés et al., 2017). That is why the object of this research are digital skills specifically applied to the business level and recent BBA graduates, hoping that it can contribute to a better understanding of these two realities (He and Zhu, 2017; Leon-Perez, 2020).

The competency-based pedagogical model is having a significant influence on the debate about aligning Higher Education to labor market requirements. For that reason, each discipline needs to continuously monitor job prospects and adjust the university's competence curricula accordingly (Wild and Schulze, 2020; López-Gil, 2020).

Following this idea, the output of this research consists of a digital competency framework that can serve as a reference both for students when entering the labor market, and for businesses when determining their needs in terms of digital preparation.

There are three main research questions (R.Q.) that this investigation aims to answer:

R.Q 1: What do digital skills consist of according to the companies' point of view. What are the elements that conform to this definition?

R.Q 2: Is there a gap separating the demands of the industry and the supply of the University in terms of digital skills?

R.Q 3: If so, how can this gap be reduced so that the expectations of the sector are in line with the offerings of recent graduates?

2 Literature review

The search was developed through the Web of Science, including terms related to digital skills or competencies.

2.1 Criteria and selection

The criteria used in the search presented the following structure:

Table 1. Search strategy, title restrictions

1ST string "OR"		2ND string "OR"
Digital skill* Digital competence* Digital capabilit* ICT skill*	"AND"	Higher education HEI (higher education institutions) Universit*

1. First stage; or automatic selection: The records identified in the initial search included 161 results. From that, an automatic filtration was done excluding review articles, book chapters, book reviews, books, and editorial materials. Conversely, the number of articles fell to 148.

2. Second stage; manual selection: A final manual selection was done based on the abstracts, excluding the results that were irrelevant to the topic. After an exhaustive reading of the 148 abstracts, 77 articles were dismissed for being out of the scope. This meant that the final review contained 71 documents, including both proceedings papers and articles.

3. Criteria of inclusion and exclusion of the articles: Articles that pictured the level of digital skills among graduates or pointed out the impact of better digital capabilities on employability were included. Instead, those that focused too much on university teachers, studying methods or schools were dismissed, since the study focused exclusively on higher education institutions.

2.2 Bibliometric analysis

The analysis of the final articles was developed manually and with the help of VOS viewer, a software tool for building and visualizing bibliometric networks. Thanks to it, information can be clustered and classified based on common characteristics and patterns. That is why most of the figures in this research come from this source.

The elements conforming to the bibliometric analysis were time frame, geography, authors, journals, and content analysis.

The samples of the different studies included mainly students in different universities, who were assessed on their self-perceived digital competencies and other matters surrounding the topic.

Some articles combined several research methods, meaning that they relied on both qualitative and quantitative methodologies for their studies.

2.3 Content analysis

The five main descriptive tags conforming the articles were clustered and organizes. These were: "digital skills", "digital tools", "teaching", "students" and "digital natives and Covid-19".

After that, a distinction between three fundamental terms was presented. These terms are digital competence, digital skills, and digital literacy. The first two concepts can be considered synonyms since they refer to the "abilities necessary for proper inclusion and participation in our digital society" (UNESCO). Digital literacy, instead, represents the ability to understand the context that surrounds digitalization (Bali, 2016).

The E.U has created a tool to identify the basic elements that conform to digital competence. This tool is known as the Digital Competence framework (or Dig Comp 2.0), and it includes a set of 21 competencies in 5 different areas. It was used as a reference to develop the digital competency framework of this research.

3 Methodology

The sample of this research consists of 14 interviews: Eleven from business realities and three from the academic sector.
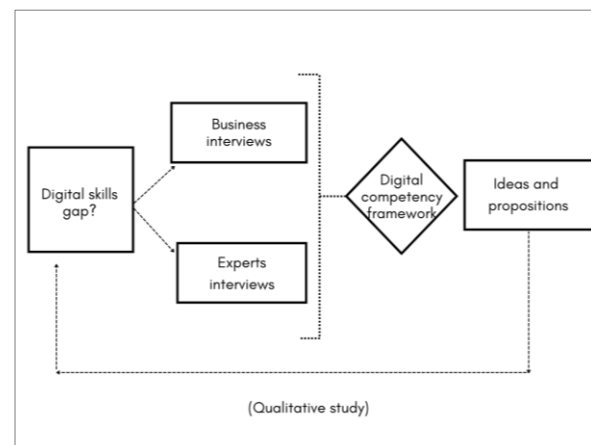
Figure 1. Structure of the research

3.1 Data collection and sample

To answer the three R.Q. we conducted a qualitative study based on semi structured survey. For data collection, people from both the business world and the academic sector (that is, university professors or researchers) were consulted. Each of them was individually contacted to schedule an interview according to their availability. Once the date was set, the interview proceeded, either in person or online (through zoom, teams or meet platform) following a pre-established thread of questions. All interviews were recorded, with prior consent, to allow a more accurate transcript of the responses.

The duration of the interviews was an average of 21 minutes each. The total duration of the recordings adds up to 274' and 45", that is, a total of 4:57 hours. The development of the interviews was online 85% of the time. Only once it was developed in person or through a written response that was provided via email.

On the one hand, experts from the university world were approached, specifically from three educational institutions (UIC Barcelona, IESE and Faculty of organization and informatics in Croatia) since their presence at the University gave them a clearer vision of the digital skills held currently by students. In addition, profiles such as Bea Lucaya (internship coordinator at UIC Barcelona) or Carlos Cosials (Industry 4.0 consultant and coordinator of the Master in Big Data, UIC Barcelona) represent a point of connection between university and business, given that they connect these two realities daily, both through teaching and service providing. In short, the profiles called "experts" were those that provided information about the HEI's offering, or what is the same, about the level of digital skills that a recent BBA graduate has today.

On the other hand, people working in companies were interviewed. The business realities were diverse, but they shared a common point: all of them hired recent business administration graduates, more or less frequently. That is why it was especially relevant to know their perspective. Ten was the number of analyzed companies, but eleven were the interviews since in the case of KPMG it was possible to contact two partners (one in the transaction services and deal advisory and the other in technology, risk, and cybersecurity). Of the ten companies analyzed, two are devoted to production (Quad pack in the cosmetics sector and Fluidra in the wellness sector) while the other 9 provide services. These go from consulting (KPMG, Deloitte, Industry 4.0 and Selliger and Conde), to courier services (Glovo), urban mobility (Yego) and financial services (Caixabank, Abacum).

3.2 Semi-structured interviews

For the data collection, an interview was developed both for businesses and experts in the field. The interview was carried out thoughtfully, to identify the existence or non-existence of a digital skills gap, and the enumeration of the skills necessary for any recent graduate coming from BBA studies.

To write these questions, it was necessary to attend to previous studies on the subject, where the style of questions could be inferred. It was not easy, because in most cases the previous studies had been quantitative using questionnaires and tests. Besides, the recipients of the questions were not normally companies but students. However, articles such as (Llorens, 2013) distinguished which generic skills were the key to enabling newly graduated engineers, basic computer, and telecommunication engineers to enter the information and communication technology (ICT)

sector. It was an important reference that helped understand how to approach businesses.

The following table contains the structure of questions that was followed in all the interviews.

Table 2. Semi-structured interviews

Presentation questions	How many years have you been in the company? What has been your career and what is your current position? Do you manage a team? If yes, how many people do you hire per year and what studies do they normally come from?
Questions about skills	What do you understand by digital skills? What are the most important digital skills that a recent graduate must have to fit in a job like this? Can you give an example of digital competence that is especially demanded? Have you seen an evolution in this demand over the years you have been in the company?
Gap	Do you understand that greater preparation of recent graduates in these skills would be necessary? Do you have any examples that can illustrate this need? Have you ever developed "training plans" for the adaptation of employees to emerging technologies?
Relationship with universities	What relationship does this company have with universities? Do you see a need for more fluid university-company communication?
Future prospects	What are your future prospects in this regard? Do you think that this demand for digital skills will increase?

3.3 Data analysis

The interpretation of the data is qualitative since the information is not given by numbers or statistical data but is expressed through the words used by each respondent to the questions formulated in the interview.

Qualitative research has been highly criticized due to its "alleged incapability" of presenting empirical evidence in its conclusions and findings (Gioia, 2012) However, this work has used qualitative study tools that have been recognized precisely because they provide credibility to qualitative analysis, given their rigorous methodology and techniques for organizing and interpreting information.

Mainly two tools were used: The Gioia method and the NVivo software. On the one hand, the Gioia method is an approach to qualitative research that consists of the organization of data into 1st and 2nd order categories to render easier the assembly of the information into a more organized form. It brings as a result an inductive model which shows the dynamic relationships among the concepts obtained and finally a narrative of the theory is developed including quotes that prove the relation between the model and the fieldwork. In conclusion, the overall objective of this methodology is to build new concepts and ideas based on fieldwork, structure them and give them a meaning that can guide future research (Gioia, 2012).

On the other hand, to classify the "raw answers" gathered from fieldwork, a software called NVivo was applied. It constitutes a data management package to support the researcher during the data analysis process which the researcher must always remain in control of (Zamawe, 2015). This tool automated the organization of the information using markers and graphics that provided even greater rigor to the analysis.

4 Results

The presentation of the results follows the order of the research questions:

- R.Q 1: What do digital skills consist of according to the companies' point of view. What are the elements that conform to this definition?

This concept has been defined within a specific scope. This research, as explained in the introduction, studies digital skills applied to the business reality. In other words, we have tried to create a conceptual framework in which the most required skills could be classified according to a logic that is consistent with the requirements of organizations (see Figure 2).

To develop this framework, the answers given by the interviewees have been used, as well as the existing model of competencies that are presented in the literature review of this same work (DigComp 2.0). Thanks to the interview with Carlos Cosials, the triple distinction between the tools was identified, and it was very useful to systematize the information and concepts that the respondents pointed out. He also highlighted the concept of "lifelong learning" as an indispensable summary of the framework.

Figure 2. Digital skills, industry demands (BBA)
Source: Own elaboration.

First, authoring tools are those used for content creation (for example, the development of a PPT presentation with the results of a certain project). These tools are mainly represented by the well-known Office package (Word, Excel, PPT...) but there are also similar programs that carry out the same functions. As mentioned by Carlos Cosials: "*In the office, according to me, you work and produce because you manipulate digital tools to create content*". The competencies associated to these tools were:

1. Creatively using digital technologies
2. Browsing, searching, and filtering data
3. Developing digital content
4. Re-elaborating digital content
5. Mastering PC and smartphone usage

Secondly, collaborative tools constitute the necessary instruments to discuss and share results with colleagues, always through digital means. Within this classification, the most frequently cited examples have been mail, the cloud, or videoconferencing platforms such as Google Meet, Teams, Zoom, etc. In other words, these are all programs that make it possible to create a "workflow" among employees where all the results are known and shared in an agile way. This category also includes programs designed ad hoc by consulting firms, which develop them after understanding the company's business model and way of working. A recent graduate can't know, let alone master, the management of this type of ad hoc designed programs, so technical knowledge of these tools is not expected but rather a package of soft competencies. The competencies associated to these tools were:

1. Collaborative thinking
2. Systematic planning and scheduling
3. Interacting and sharing through digital technologies
4. Protecting personal data and privacy

Finally, transactional tools are those where all the information related to business activity is centralized. An ERP (enterprise resource planning) refers to the

tool that allows the centralization of the information regarding all the company areas (such as HR, SCM, CRM, etc.). According to Judit Gispert, an ERP is the *"backbone of the company where all its information is dumped"*. Most of the time we talk about SAP, SAJE or Oracle platforms, but in any case, there are also ad hoc tools for each company that are highly adapted to their business model. The skills associated to these tools were:

1. Analytical thinking
2. Evaluating and managing digital content
3. Adaptability and flexibility
4. Proactivity
5. Digital literacy
6. Cybersecurity

All in all, the digital competence that will be required for a recent graduate can be identified always according to their ultimate utility. That is why this framework serves as a benchmark where the demands of the industries are properly organized and systematized.

- R.Q 2: Is there a gap separating the demands of the industry and the supply of the University in terms of digital skills?

To answer this question, it is necessary to look at the interviews. Most of the time, the ideas were repeated but formulated through different words. Therefore, it was necessary to regroup all the answers that referred to each question to find a common pattern. This was done through the NVivo software, which apart from classifying the citations, also offers the possibility to classify the categories of response ("nodes") according to the weight given to each of them. All in all, it was possible to obtain a hierarchical map showing each category with its respective weight, which is directly correlated to the frequency of references inside that group.

1. Analytical thinking competency was the most mentioned. This competency refers to the ability to *"interpret the information provided by our (digital) tools"*, Maite Poyos. In the opinion of most of the interviewees, this was a competency that although it has not been in demand to date, it is now that information is provided through large amounts of data. Some even believe that this will be the job of the future *("I think that at some point the market will require a change and analysts will be the most sought-after figure in a company"*, Matteo Saita). It is also referred to as "critical thinking".

2. Adaptability and flexibility also had a considerable weight. This skill is understood as the *"ability to adapt to all the changes in a more agile way than the rest"*, Sergi Gil. It has been very often cited since any recent graduate when he/she finishes university, is immersed in a completely new reality, where he/she will also have to work with new tools, especially digital. In this context, the willingness to learn or the flexibility to embrace change is important.

3. Another very frequently cited competency was mastering PC and smartphone usage. Most of them referred to the fact that the main work tool with which a worker spends the whole working day with is the computer. In this sense, the idea was repeated that a recent graduate cannot be unaware of how to use it. *"The first thing they will give you when you start in a position is a computer, so from that moment on you can't be a stranger to the use and handling of it"*, Jorge Lluch.

4. The ability to develop digital content, on the other hand, has been constantly linked to Excel mastery. Any recent graduate is expected to know how to develop content through this tool not only at a basic but also at an advanced level. *"Right now, I wouldn't hire anyone who doesn't know how to use Excel"*, Beatriz Gisbert.

5. Among the least cited competencies there are collaborative thinking, cybersecurity, interacting and sharing through digital technologies, protecting personal data and privacy or systematic planning and scheduling. Most of them are competencies belonging to the category of collaborative tools.

- R.Q 3: If so, how can this gap be reduced so that the expectations of the sector are in line with the offerings of recent graduates?

Formation could be seen as the first solution. Most companies, especially the bigger ones, already offer courses for the digital education of their employees. In these courses, they can get in touch with the specific software that the employees manage on a day-to-day basis ("*We train based on what we need"*, Sergi Gil). Some companies even have platforms where all the courses are offered for the employee to choose *from ("LinkedIn learning is that platform where everyone can organize their training as they want"*, Judit Gispert).

Some training is developed hand in hand with a senior employee that has experience in the job and can teach the recent graduate how the system works ("*When we hire, the person leaves the career, we put him/her together with seniors and we train him/her by participating in projects"*, Sergi Gil). These training plans can be mandatory or not, always depending on the needs of the company.

Other ideas were shared such as the importance of mixing university and companies, the need for a more digitalized education at university level, the need for "hybrid profiles", that can combine business knowledge with the mastery of essential digital programs.

Lastly, the idea of "lifelong learning" was presented as an innovative approach to university education. It consists of the reduction of university timings that allow for faster insertion of students in the

working field, ensuring that their education is monitored over the years.

5 Discussion

After a thorough analysis of the interviews, the answer to the first research question is given in the form of a competency framework. It is not a closed classification since can be expanded and changed over time and depending of external situations as COVID (Batez, 2021; Heidari et al., 2021). This framework is intended to reflect the current reality of digital skills, according to the opinions of various experts in the field. It can serve as a basis both for companies (to detect the ideal profile for their needs) and for recent graduates (to have a reference of what can be expected of them in terms of digital skills). All in all, it represents a relevant and up-to-date contribution.

On the one hand, three types of tools have been distinguished: authoring tool (where the output is created from scratch), collaborative tools (through which employees work together) and transactional tools (where all the information regarding the business activity is centralized). Each of these tools has been associated with a series of competencies, fifteen in total, which have been analyzed according to the importance attributed by the interviewees.

It is worth noting the high weight given to competencies such as analytical thinking, adaptability, and flexibility to the detriment of others such as cybersecurity or systematic planning and scheduling (He and Zhu, 2017). The fact that the most frequently cited competencies have to do with transactional tools may lead one to think that these represent the main driver of value creation for the company today. In any case, it is understood that the interpretation and management of large databases represent an indispensable requirement for today's business reality.

On the other hand, it has been observed that companies are not so much interested in the executive aspect, but rather the soft skill preparation of students at the university level. That is, they do not expect recent graduates to know how to handle digital tools created ad hoc and specific to their business models, but rather they expect them to be able to adapt quickly to the digital reality of their company.

However, it should be noted that there are some tools of which mastery is expected, including video conferencing tools, the cloud, google workspace and the classic Office package (especially relevant at this point is the mastery of advanced Excel).

All in all, it could be said that there is a strong awareness on the part of companies of the importance of hiring people with adequate digital skills, according to Llorens (2013). But above all, they search for people that can adapt and dynamically embrace change. All this is because we are in a constantly changing reality, where tools evolve, and people are expected to evolve at the same pace. However, we must not forget that

technology should not become the end of the organization, but the means to achieve business objectives.

6 Final remarks and implications

This study is highly practical for both academia and the business sector. It is in line with two of the thirty sustainable development goals proposed by the United Nations: "Quality education" as well as "Decent work and economic growth".

It differs from other studies in that it focuses on the opinion of companies, and not so much on the perspective of professors or professionals in the University. In this way, the results can represent a point of reference both for companies when hiring personnel and for recent graduates when entering the labor market. It should not be forgotten that one of the objectives of the university, especially in a faculty of business studies, should be to bring students as close as possible to the business reality.

Apart from the implications and practicality of this study, there are also several limitations, including the fact that it is a purely qualitative perspective. This study has analyzed the responses of 14 companies and experts to an interview. These results could be enriched by the quantitative study of data that could reinforce the ideas expressed above.

On the other hand, it should be noted that the companies were interviewed at the national level. That is, they are Spanish professionals except for the case of Ivan Malbasic, from the Faculty of organization and informatics in Croatia. This means that the conceptual span is narrower and that opinions from countries other than Spain cannot be reflected.

Finally, the number of interviews has been reduced given the limited availability of resources. A larger number of interviewees with a greater variety of companies could allow for a more rigorous analysis.

Nevertheless, this topic should be the object of further research to try to clarify how the reality of digital skills evolves in the future and how recent graduates should prepare themselves accordingly.

Acknowledgments

References

Bali, M. (2016, 02 03). *Literacy now*. Retrieved from International literacy association: https://www.literacyworldwide.org/blog/literacy-now/2016/02/03/knowing-the-difference-between-digital-skills-and-digital-literacies-and-teaching-both

Batez. (2021). ICT Skills of University Students from the Faculty of Sport and Physical Education during the COVID-19 Pandemic. Sustainability, 10.

Crawford-Visbal, C.-T. O.-Z. (2020). Competencias Digitales en estudiantes de Comunicación a través de cuatro universidades latinoamericanas. Education in the Knowledge Society (EKS), 5-10.

Gioia, K. G. (2012). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, 17.

Guzmán-Simón, F., García-Jiménez, E., & López-Cobo, I. (2017). Undergraduate students' perspectives on digital competence and academic literacy in a Spanish University. Computers in Human Behavior, 74, 196-204. https://doi.org/10.1016/j.chb.2017.04.040

Handley, F. J. L. (2018). Developing Digital Skills and Literacies in UK Higher Education: Recent developments and a case study of the Digital Literacies Framework at the University of Brighton, UK. PUBLICACIONES, 48(1), 109-126. https://doi.org/10.30827/publicaciones.v48i1.7327

He, T., & Zhu, C. (2017). Digital informal learning among Chinese university students: The effects of digital competence and personal factors. International Journal of Educational Technology in Higher Education, 14(1), 44. https://doi.org/10.1186/s41239-017-0082-x

Heidari, E., Mehrvarz, M., Marzooghi, R., & Stoyanov, S. (2021). The role of digital informal learning in the relationship between students' digital competence and academic engagement during the COVID-19 pandemic. Journal of Computer Assisted Learning, 37(4), 1154-1166.

Jiménez-Cortés, R., Vico-Bosch, A., & Rebollo-Catalán, A. (2017). Female university student's ICT learning strategies and their influence on digital competence. International Journal of Educational Technology in Higher Education, 14(1), 10. https://doi.org/10.1186/s41239-017-0040-7

Kim, H., Hong, A., & Song, H.-D. (2018). The Relationships of Family, Perceived Digital Competence and Attitude, and Learning Agility in Sustainable Student Engagement in Higher Education. Sustainability, 10(12), 4635. https://doi.org/10.3390/su10124635

León-Pérez, F., Bas, M.-C., & Escudero-Nahón, A. (2020). Self-perception about emerging digital skills in Higher Education students. Comunicar, 28(62), 91-101. https://doi.org/10.3916/C62-2020-08

Llorens, L.-A. (2013). The ICT skills gap in Spain: Industry expectations versus university preparation. *Computer Applications in Engineering Education*.

López-Gil, B. B. (2020). Teaching in the Network Society: analysis of the digital competences of students in Education at the University of C diz. International journal of educational research and innovation, 53.

López-Meneses, E., Sirignano, F. M., Vázquez-Cano, E., & Ramírez-Hurtado, J. M. (2020). University students' digital competence in three areas of the DigCom 2.1 model: A comparative study at three European universities. Australasian Journal of Educational Technology, 69-88. https://doi.org/10.14742/ajet.5583

Mattar, J., Ramos, D. K., & Lucas, M. R. (2022). DigComp-Based Digital competence Assessment Tools: Literature Review and Instrument Analysis. Education and Information Technologies, 1-25.

Mengual-Andres, S., Roig-Vila, R., & Mira, J. B. (2016). Delphi study for the design and validation of a questionnaire about digital competences in higher education. International Journal of Educational Technology in Higher Education, 13(1), 12. https://doi.org/10.1186/s41239-016-0009-y

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. Cogent Education, 5(1), 1519143. https://doi.org/10.1080/2331186X.2018.1519143

Wild, S., & Schulze Heuling, L. (2020). How do the digital competences of students in vocational schools differ from those of students in cooperative higher education institutions in Germany? Empirical Research in Vocational Education and Training, 12(1), 5. https://doi.org/10.1186/s40461-020-00091-y

Zamawe, F. C. (2015). The Implication of Using NVivo Software in Qualitative Data Analysis: Evidence-Based Reflections. *Malawi Medical Journal*, 3.

Zhao, Y., Llorente, A. M. P., & Gómez, M. C. S. (2021). Digital competence in higher education research: A systematic literature review. Computers & Education, 168, 104212.