Developing Digital Skills: Results of a Social Innovation Project in the Technology Sector

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Abstract:

Purpose: This paper presents results of the quality research focused on developing digital skills. The main objective of this study is to analyze how digital skills can be defined and developed through a social innovation project based on workshops and close cooperation with information technology companies.

Design/Methodology/Approach: This study was prepared based on the literature review about digital skills. At the final stage of the realized grant project, (in the sixth month) quality research (structural interviews) among all participants was realized.

Findings: The results of the research showed that it is valuable to define and develop soft digital skills as well as advanced technical skills. The development of digital skills is a process that could be significantly supported by interinstitutional cooperation. The realization of team projects from the business, close collaboration with companies, and additional workshops significantly influenced the development of digital skills.

Practical Implications: The way of developing digital skills can be adapted and implemented in business. Formulated recommendations can be useful for educational institutions and companies interested in developing digital skills more relevant to current business needs.

Originality/Value: This study implemented a comprehensive approach to defining digital skills. Soft digital skills, as well as advanced technical skills, were analyzed. This is empirical research realized based on the 6 months grant project with close collaboration with business. Based on it insights about developing digital skills were identified.

Keywords: Management, digital skills, soft skills, advanced technical skills, IT companies.

JEL Classification: M12, M15, O15, O21, O35.

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1. Introduction

Digital transformation changed the employee skills that organizations need to succeed (Ostmeier and Strobel, 2022). This is caused by the fourth industrial revolution that transforming many industries globally (Mohammed and Trzcieliński, 2021). Therefore, it is necessary to identify in which way it is possible to shape employees` skills and future employees` skills to face employers` expectations of adequate to dynamic changes in industries. Technology development caused, that simple tasks are realized by intelligent equipment, robots, or virtual machines. It means that in the future, employees carrying out simple tasks will be unneeded (Lloyd and Payne, 2022).

So who will be needed? According to the results of research, employees who can collaborate and solve problems using critical thinking. Those skills were defined in the scientific literature as `digital skills` (Van Laar, 2019; Xu, 2019). Future employees should have skills and knowledge of technology as well as knowledge of the business. In most cases, however, during the education process, students from social science are focusing on developing social skills, while in engineering studies only technical skills are developed. As researchers underlined "comprehensive education usually needs a couple of years, but enterprises can not wait for years" (Bernsteiner *et al.,* 2021).

Therefore, the research problem which was identified is based on the research question: *How to develop digital skills adequate to current business needs?* To find answers and explore this topic, quality research was conducted to provide deeper knowledge and identify undiscovered insights about developing digital skills relevant to dynamically changing business. Especially, that researchers confirmed, that employees` skills have an influence on companies` innovations (Ueki and Martínez, 2020) and performance (Webb and Layton, 2022).

Apart from an introduction including a short description of the identified research problem, this paper presents the following points. The starting point is a literature review, including the most relevant references about digital skills and developing them, published in international scientific journals. Next, the research methodology and context of the research are described. The main parts of the paper are the results of realized quality research using structural interviews with all participants of the grant project. The last part includes discussion and conclusions, containing also limitations and directions for future research.

2. Theoretical Framework

Digital skills are not a totally new topic but currently have become an urgent theme. It is fully understandable because technology transformation and Covid-19 had a huge influence on the popularization and level of usage of the technology in many different sectors of business (Mazuchenko *et al.,* 2022; Webb and Layton, 2022).

As a consequence, digital skills are required more and more in the current world. Moreover, the rapid digitalization caused, that workers should acquire digital skills beyond mere technical use (van Laar, 2022).

Based on the Web of Science Core Collection, it is visible clearly, that number of papers focused directly on digital skills has increased for years and developed in the last years. In 2007 and 2009 only 1 paper with *"digital skills"* in the title was published, but in the next years number of papers was increasing: 7 (2011), 8 (2012), 9 (2013), 6 (2014), 12 (2015), 21 (2016), 26 (2017), 24 (2018), 38 (2019), 57 (2020), 56 (2021) and 27 papers in the first half of 2022, bringing 293 positions in total. For this study, the above papers were analyzed and the most relevant of them (especially the newest) provided a theoretical ground to design this study.

According to the literature review, it is possible to identify two main approaches to defining and analyzing digital skills. The first approach is focused on technical orientation. Especially in the earliest research, digital skills were defined as technical skills and competence, where information and communication technologies play a key role (Punie and Ala-Mutka, 2007). Therefore, digital skills were defined as, skills to operate digital media, handle the special structures of digital media (such as menus and hyperlinks), skills to search, select and evaluate information in digital media, or skills to employ the information contained in digital media (van Deursen and van Dijk, 2009). This technical-orientated approach was used also later (Claro *et al.,* 2012). Moreover, this orientation is still being used, and digital skills are analyzed as the ability to operate a computer and browse the internet (Bhandari *et al.,* 2021).

The second approach to defining digital skills is more socially oriented. It is articulated in the last few years. In 2017, types of 21st century digital skills were identified. There are the following: communication, collaboration, information management, critical thinking, creativity, and problem-solving skills (van Laar *et al.,* 2017). Later, in 2018 the framework with core 21st century digital skills included also a seventh, technical dimension (van Laar, 2018). In the next study, the following digital skills were investigated: information, communication, collaboration, critical thinking, creativity, and problem-solving (van Laar, 2019).

Another researcher who analyzed skills in the digital age, as crucial identified: teamwork, flexibility, creativity, communication skills, and critical thinking (Vrabec, 2019). The other researcher was focused on communication skills, content creation, and creativity (Gomez-Orjuela, 2021). Others claimed, that creativity and innovation are only just some digital skills required for future professionals in the labor market, so the list of digital skills should be enhanced (Gallego *et al.,* 2020). They were analyzed also as "a complex system of a personality, associated with `responsibility` and `information`, with the individual's readiness for network interaction, with information skills, and the ability to generate and maintain online content" (Bulganina *et al.,* 2021).

Also, the following dimensions of digital skills were analyzed, computer literacy, communication and collaboration, creation of digital content, security, and problem-solving (Cateriano-Chavez *et al.,* 2021). Moreover, recommendations were formulated that currently, digital training skills should lead to the ability to use knowledge to adapt to problematic situations, use critical judgment, and react quickly (Campana, 2021).

Based on the literature review, it is visible, that there is no single approach to defining digital skills. In different studies, varying definitions of digital skills were used. Moreover, the concept of developing digital skills referred to digital competencies, digital literacy, or technological skills as well. Lack of consistency in terms was clearly presented in a systematic literature review conducted by van Laar (2017).

However, it is possible to identify two main approaches to defining digital skills. The first is focused on technical skills like the ability to use the computer or internet, and the second defines digital skills as socially orientated including e.g. collaboration, communication, and problem-solving (soft skills). Therefore, for this study, both approaches are used. Digital soft skills were defined recently so they are implemented and only some of them are developed through collaboration with employers to update them and adapt to current needs. However, the list of technical digital skills definitely requires to be updated and analyzed on an advanced level, e.g. the ability to program.

Therefore, in this study, they are called advanced digital technical skills. The list of those skills was prepared in close collaboration with IT companies. To summarize, the concept of digital skills in this study is combined with digital soft skills as well as advanced digital technical skills as the most comprehensive approach. The incentive to implement this approach was the study (Freiman *et al.,* 2017) focused on exploring a combination of soft skills and technical skills development as well.

After defining the concept of digital skills it is valuable to embed this topic in the context, where digital skills will be analyzed. In the scientific literature, often the role of educators, teachers, and universities is underlined, in shaping young people's skills to face the challenges of modern society (Bulgania *et al.,* 2021; Perifanou, 2021; Tomczyk, 2021; Torres-Florez, 2021). Higher education can also create a new workforce from the perspective of the development economy (Babic, 2021).

In 2021, there were formulated recommendations, that digital skills education should be based on GlobaStandardsrs and Coordination. This framework is dedicated to all countries in the world and based on stakeholder engagement. As a fundament of standards were identified: academic research, initiative leaders, content developers, and distribution partners (Jackman *et al.,* 2021). Therefore this research focused on developing digital skills, are based on the cooperation between university – students

– and companies. As a result, wider and deeper knowledge about developing digital skills through that kind of cooperation is expected.

The idea of this research is not to confirm some hypotheses but identify insights. It is fully coherent with researchers` recommendations: "this era of compulsory computing demands new ways of measuring and theorizing about digital skills" (Allmann and Grant, 2021). Researchers underlined it because in previous research two methodologies dominated: (1) self-assessment surveys and (2) performance tests.

Therefore they used and recommend a qualitative method for future research, to add "important nuances to prior, predominantly quantitative, analyses of digital skills" and they suggest rethinking the theory of skills. Therefore this study is based on qualitative research focused on developing students` digital skills. Those skills include soft skills as well as advanced technical skills. In summarizing, in order to show wider earlier research also bibliometric review was realized. Based on words digital skills (in a different configuration in titles) 983 positions were founded. Results of the bibliometric review were presented in Figure 1.

Figure 1. *A bibliometric review of research on digital skills*

Source: *Author's elaboration*

According to the bibliometric literature review, digital skills are related to education, higher education, innovation, technology, and performance. There is a research gap between digital skills and companies or industries. Therefore, in this study companies from the technology industry are invited to contribute to shaping and developing digital skills.

For this study, a grant project was realized to analyze how digital skills can be developed through additional workshops and close cooperation with companies from the technology sector. The grant project funded by European Union was realized. The concept of the grant project was coherent with the European Union Program, targeted to searching for creative ways of social solutions (social innovations) for supporting the professional development of young people.

3. Research Methodology and Context of the Research

The main objective of this study was to analyze how digital skills can be developed through additional workshops and close cooperation with IT companies based on working on real IT projects. Therefore the theoretical aim was to identify the most relevant approach to defining digital skills based on the literature review. The empirical research aim was to explore developing digital skills based on the structural interviews after participation in a grant project.

This research was realized thanks to the grant project funded by the European Union Program "Knowledge – Education – Development". The assumption of the grant project was to test the social innovation model of cooperation between university, computer science students, and IT companies and during this cooperation develop students` skills. The grant project lasted six months. The main line of the cooperation was the realization of IT projects commissioned by IT companies. It was the main line of cooperation to improve digital tech skills.

Moreover, it was enriched by actions focused on soft skills as well. Those actions included: week-by-week meetings in companies, support of IT Mentor and Business Mentor, and arranging eight workshops improving soft skills among all grant project participants: 1) Communication in the team, 2) Working in the project team, 3) The recruitment with assessment center, 4) Laber market in IT sector, 5) Developing start-up, 6) The agile development, 7) The art of public speaking, 8) Openness to change.

Workshops were realized in the business environment in conference rooms in companies. Workshops were conducted by highly qualified specialists from business. Some of the workshops were realized even on the theatrical scene with professional actors. At the end of the project, all participants also took part in the international conference, so they had the opportunity to go out of their comfort zone and present their experiences.

The main line of cooperation between future engineers and IT companies was the realization of selected IT projects. The essential aim was to provide for companies with valuable results, in parallel to improving students` digital skills (soft and advanced technical skills). Selected IT projects that students realized were as follows:

1) Telemetry application,
2) Interactive rehabilitation-training assistant,
3) Development of a prototype 3D scanner capable of applying color texture.

The participants of the grant project were selected and divided into three teams. Among over 250 candidates for the grant project, 9 of them were selected and invited. There were students in the Information Technology studies (the last year of the Bachelor's degree). There were 8 men and 1 woman. There were selected because their skills indicated in the survey were the most relevant to IT projects and companies` expectations. The sample was not so huge (9 participants) however as was underlined the main line of the whole social innovation project was to test as a prototype the model of close cooperation between students and IT companies and develop digital skills. That is why the group consisted only of 9 participants.

According to the grant project assumptions later, based on these experiences, the tested model was planned to popularize with theoretical and practical recommendations focused on developing digital skills. In this research, the digital skillset included soft skills as well as advanced technical skills. The list of them helped to select the grant project`s participants. They can be found in Table 1.

Table 1. *Digital skills are taken under consideration while selecting participants for the grant program and creating project teams*

Soft skills:	Advanced technical skills:
Communication	C#
Collaboration	C
Critical-thinking	VB.NET
Creativity	Asp.Net
Problem-solving	HTML5
Teamwork	JavaScript
Innovation	Java
Information management	PHP
Presentation skills	MS SQL
Openness to learn	MySQL
Adapt to changes/react quickly	Graphic skills

Source: *Authors' work based on the literature review and collaboration with IT companies.*

All candidates at the beginning of the grant project in the selection stage rated the level of their digital soft and advanced technical skills. Every skill was rated separately. The 5-point Likert scale was used to rate it. Also, companies rated every

single digital skill, which they expect from participants in the proposed IT project. Based on the answers IT projects and participants have been chosen.

Developing digital skills based on the new model of cooperation with a small number of participants was the assumption of the grant project. Therefore, the quality method was identified as the most relevant to conduct valuable research. Interviews were realized after 6 months at the end of the grant project. Interviews were structuralized, in the same way for each participant. The scenario of interviews consisted of open questions to collect as deep and wide insights as possible. The scenario of structural interviews with participants was presented in Table 2.

Table 2. *The scenario of structural interviews with participants*

No.	Questions in interviews at the end of the grant project:
1	In which way did your participation in this project influence you?
2	What was the biggest success for you during this project?
3	What was the most valuable experience for you during this project?
4	According to you, what skills did you improve the most?
5	What was the most unique experience you remember from the whole project?

Source: *Authors' work based on the literature review and collaboration with IT companies.*

Every interview with every participant was conducted separately. All interviews were recorded with the participant's consent. Every participant was informed about the aim of the research and got to know the structure of the conversation. The next step was the transcription. Next, written answers were analyzed, selected, and sorted into thematic groups to identify the main insights from the grant project developing digital skills.

4. Empirical Results

4.1 Participants` Development

The first opening question in interviews was: "In which way did the participation in this project influence you?"

The answers to this question were open, wide, and diversified. After the transcription, answers were analyzed and sorted into thematic groups. Based on the answers provided, the main topics were identified: digital tech skills, self-development, teamwork, communication, project management, time management, and entrepreneurship. Emotions as an additional dimension of answers also were identified.

The first identified topic of answers was related to technical skills. Participants told about programming skills, creating MVC patterns, generating 3D models, and preparing website layouts. It was visible based on sentences like: *I have become*

more familiar with ASP. NET MVC technologies and the mechanisms that occur there; I have a better understanding of image processing; I can generate a 3D model with textures; I discovered that I can program well; I have a better understanding of MVC patterns; I have improved my design skills; I can lay out an entire website on my own; I discovered that the 3D printing method is one of the most future-oriented technologies.

The second topic which was found in respondents` answers was self-development. Sentences like: *I have a better understanding of my character and the reasons for my behavior; I am more aware of my advantages and disadvantages; I can better identify my good and weak points; I am more organized; I have discovered that I have natural qualities that can be developed;* showed that participants after the project and social activities are more aware of them.

The third discovered topic was strongly linked with teamwork and communication skills. Teamwork was the area that was mentioned the most often. A lot of examples are as follows: *I learned how to work in a group; I have improved my group work; I am convinced that after participating in this project I will do better in teamwork; I have a better understanding of communication problems in a team; I discovered that working in a team was not my forte; I can work better in a group; I can work better in a team; I now have less fear in myself about working with people; I am more forgiving of others' mistakes.; I have discovered that I have an aptitude for managing a team.*

Part of the statements were very close to the work team as well as communication skills. It is possible to see it based on examples like: *I am more open; It is easier for me to talk to people; I have improved my self-presentation skills; I can improvise in public speaking, even on the theatre scene; I discovered that everyone sees things from a different perspective so it is always important to make sure we agree.*

The fourth group of skills that were found in participants` answers was related to management, especially project management. Answers were not so frequent as in former groups but for a few participants, there were essential, what following examples about project management showed: *I learned about planning and problem-solving methods; I have a better understanding of how to work in agile and scrum methodologies, and* time management: *I can make better decisions and manage time; I have improved my time estimation; I have improved my work organization and discipline.*

The fifth main topic identified in participants` answers was related to entrepreneurship. Some of those sentences were focused on entering the labor market: *I have a better understanding of recruitment in the IT industry; I discovered that a job interview is not so scary; I can draft a resume that is attractive to employers; I am confident that the experience I have gained will positively affect my position on the job market.* Other sentences underlined a better understanding of

entrepreneurship and conducting business: *I have a better understanding of how software companies operate; I have a better understanding of employers and can put myself in their shoes.*

Additionally, apart from sentences focused on the main five identified topics, it was possible to hear the emotions, that participants felt as an approach for the future. Examples of thsentencesnces are below: *Now I am more motivated; I now have a sense of confidence and peace within myself; I now have the motivation within me to do better and fight against difficulties; I am convinced that this project has helped me a lot in my development and I would regret if I had not applied here; I have made new friends; I am more motivated to work as a programmer; I am convinced that most of the new skills will come in handy in the future; I discovered that I can do much more than I thought I could; I now have a lot of motivation in me to expand my knowledge of design; I am confident that I will take part in a similar project in the future; I now have within me the enthusiasm to take on more projects; I now have a lot of energy in me to take action. I now have in me the desire to carry out more projects. I am more confident; I am more open-minded.*

As it can be seen a lot of sentences were related to feelings and emotions. They are not linked with some particular topic, but they perfectly showed how the project which linked digital tech skills and social skills influenced their feelings and approach to the future.

4.2 Participants` Successes

The second question in the interviews was "What was the biggest success for you during this project?" After collecting participants` answers, they were selected and sorted into two groups: answers related to success in digital advanced technical skills and success in improving soft skills.

Participants` answers related to digital advanced technical skills were the following: *developing programming skills, resolving several difficult programming problems related to the operation of the information system implementing on of DSLR control via the desktop progrcreatingtion of 3d model to .ply, .obj converter with texture support, implementation of texture support in existing 3d viewer.* Based on the answers three main digital advanced technical skills were identified. They are: programming skills, creating models, and usspecializedised programs.

The second group of skills was focused on digital soft skills. Those answers were sorted. Based on this procedure the following soft skills were identified: presentation skills, building relations in teams, openness to change and resilience, communication skills, and building relations with the business. The examples of answers about the presentation skills were like: *the biggest success for me was breaking through from public speaking* or *learning to better self-presentation.* Building relations in the team was also described: as *working as a team with a person who was difficult to*

*communicate with; for, me the bigger success was building new friendshiOpenness*ness to change and resilience was not called by those words, butmeaningeainexactlyexacly related to those behaviors The answers showing that were as follow: *The biggest success for me was that we completed an ever-changing project.* Another answer: *the biggest success was overcoming internal barriers and resistance, getting out of my comfort zone, and overcoming my own internal barriers.*

The major of participants were describing the biggest success connected with communication skills. The examples of those answers are like below: *the biggest success was learning to solve problems related to poor communication between people; for me, the biggest success was learning to express my opinion, even though it can cause conflict.* The last area also is related to communication and cooperation but focused more particularly on relations with business. The examples of those answers are: *Ability to talk about successes and failures with the company's manager; Presenting assumptions and completed work in front of the company's management at an official important meeting; My biggest success was hearing positive feedback from future users of the software application that we created.*

In summarizing, participants gladly and openly described their successes. The majority of them described more than one specific success. What is surprising, although participants were future engineers, they were focused stronger on digital soft skills, which they found as the biggest success.

4.3 Participants` Experiences

The third question in the interviews was: "What was the most valuable experience for you during this project?"

All participants` answers were sorted thematically. The main topics which were identified after analyses are: soft and advanced technical skills, project management, responsibility, and contact with the business. Every participant described only one most valuable experience. (Numbers below marked participant`s answers)

For four participants the most valuable experiences were related to soft and advanced technical skills. It was identified based on sentences such as: 1 *The most valuable experience for me was attending the workshop in the theater because it required me to get out of my comfort zone*. 2) *The most valuable experience for me was learning the ins and outs of creating a 3D model because it involves a lot of mathematical problems. I enjoyed implementing algorithms because of their mathematical outline. 3) The most valuable experience for me was working with unfamiliar technology and working with others in a group because the organization of group work requires the division of roles and the classification of skills. 4) The most valuable experience for me was the actual work in a company to build a 3D*

scanner and the workshop in the theater because of getting out of my comfort zone and having to find myself in a new situation.

One participant was focused only on social experiences, the other one was focused only on the technical dimension. Two of the participants included in their statements soft and advanced technical skills as well.

The above topic is partly related to the next identified topic which is project management. An example of the participant`s answer is the statement: 5) *The most valuable experience for me was planning the target project because it showed me how much time needs to be spent on planning before work on the code begins.* Surprising could be the statement of one of the participants who was focused on responsibility and engagement in the project: 6) *The most valuable experience for me was trying to take the burden and responsibility for the project. Reconciling learning with work, because it took a special commitment. I had moments of weakness and wanted to give up, but my ambition did not allow it.*

Three of the participants claimed that the most valuable experience is related to collaboration with real business. They said: 7) *The most valuable experience for me was meeting with [company`s name] because I saw what the whole 3D printing procedure is like.* 8) *The most valuable experience for me was working with a mentor from the company's side because he gave us a lot of valuable and useful tips and guided us in the right direction.* 9) *The opportunity to carry out real IT jobs in a real business environment (…) is a very important and unique experience for a person entering this industry.*

Summarizing this part of the research it is possible to underline participants' perspectives. An insight identified based on those answers is that interdisciplinary and interinstitutional experiences are the most valuable.

4.4 Soft Skills and Advanced Digital Tech Skills Improved During the Project

The fourth question in the interviews was: "According to you, what skills did you improve the most?"

All participants indicated few skills. What is important the respondents were not asked to indicate both types of skills. An interviewer did not ask additional questions. The interview question was exactly like the above and the answers were exactly like the respondents said. Afcollectingcing allanswersnwers they were sorted and below they were listed in two groups: soft skills and advanced digital tech skills.

As improved advanced technical skills respondents mentioned: *I think I improved the most programming; For sure I improved using .NET, ASP.NET, and bootstrap; I improved JavaScript and others related to building websites earlier I knew only a little about them; For sure I improved building Web Applications; I improved my*

technical skills including GIT; The most I improved web applications programming skills.

As improved digital soft skills project participants indicated: *teamwork; expressing opinions and needs; communication skills; openness to people; building trust; managing time; self-presentation; project management; prioritizing tasks; self-confidence and openness to new challenges.*

4.5 The Uniqueness of the Project Linking Soft and Advanced Technical Skills

The fifth question in the interviews was "What was the most unique experience you remember from the whole project?"

Every participant answered this question very shortly and although they did not hear each other, they created very similar answers. All answers created a very clear picture of how developing digital skills and working he self-development was unique for project participants. Only two of the participants were focused on technical aspects. Their answers were: 1) *What I will remember the most is the difficulty in optimizing the animation on the Raspberry Pi, which caused a big slowdown in the development of the application there was more to do later. 2) I will most remember scanning the first object.*

The rest of the respondents as a unique experience found a possibility to improve their soft skills with professional trainers and attitude toward their development 1) *I will most remember the scenes played out during the workshops conducted in the theatre.* 2) *I will most remember the labor market workshop and the entrepreneurship workshoptrainersrs gave us valuable tips on recruitment and the IT market.* 3) *I will remember most the positive and smiling project participants (and mentors), and the good atmosphere* 4) *I will most remember the 2nd workshop in the theater, the workshop on project management according to Scrum principles* 5) *I will most remember the meetings at the workshop.* 6) *I will most remember the time spent in soft skills training.* 7) *I will most remember the workshops in the theater conducted for us by professional actors.*

Those answers showed how strongly unique the possibilities to work on digital soft skills were. It could be a fundament to formulate recommendations for the future to enrich future engineers in experiences and possibilities to improve their advanced technical skills as well as their digital soft skills too. It showed that there is a real need to design career paths more interdisciplinarily.

5. Discussion and Conclusions

Because of the digital transformation, developing digital skills was identified as one of the most important gaps for future education (Jackman et al., 2021; Gomez-Poyato *et al.,* 2022; Nguyen *et al.,* 2022) and the direction of developing employees

(Borbely, 2022; Wong *et al.,* 2022). Therefore, this study aimed to find answers to the question "how to develop digital skills to shape them relevant to dynamic changes in business?". To achieve this aim, the grant project in close cooperation with IT companies has been conducted for six months. After this period quality research (structural interviews) with all participants was realized. Based on it, some insights were identified.

Firstly, it is worth underlining a new approach to defining digital skills. Former researches about digital skills were siloed - focused on technical skills or focused on soft skills. In this study, both orientations were combined as the most comprehensive approach. It could be a theoretical implication and contribute to the literature on digital skills.

Moreover, the list of soft digital skills, as well as an updated list of advanced technical skills located in this study, could be the starting point for future research. Combining two diversified approaches to analyze digital skills was used also to build social entrepreneurship and digital skills for students at community colleges (Yu *et al.,* 2022). It seems that researchers` recommendation (Allmann and Grant, 2021) to find new ways of measuring and theorizing digital skills has become implemented not only in this study.

Secondly, based on interviews, it is possible to identify which digital skills were improved the most during the grant project. There are the following: advanced digital technical skills, self-development, teamwork, communication, project management, time management, and entrepreneurship. As the biggest success participants described not only successes related to programming, creating models, and using specialized programs.

They found their success in also developing soft skills like building relations in a team, openness to changes, or communication skills, which might be surprising because grant project participants were engineering students. After all, in the current studies, this social orientation is essential and still predominant. It is visible in the newest research focused on digital skills, which are defined as, information management, information evaluation, communication sharing, communication building, communication networking, collaboration, critical thinking, creativity, and problem-solving (Ujwary-Gil and Godlewska-Dziboń, 2022)

Despite some theoretical and practical contributions, the study has some limitations. The first and obvious limitation is caused by the small sample in this project and research. The project was conducted with a maximum sample as possible taking into account assumptions of the grant project, and interviews were conducted with all participants. However, a bigger sample could provide deeper and wider insights.

The second limitation is related to the sector of the industry. The information technology sector and IT companies are open to cooperating with other institutions.

IT companies have a lot of project ideas that could be the main line of cooperation with students. Nevertheless, it is unknown how that kind of cooperation would work in other sectors of business e.g., medicine, bioengineering, or automotive.

The third major limitation has methodological nature. It would be clearer to conduct quantity research. Whereas, because of the nature of the research project and the number of participants in the grant project quality research was identified as the most relevant. Comparing it with other newest research, a qualitative approach was used also in the last paper prepared by researchers who specialized in digital skills, formulated four research questions, and conducted semi-structural interviews (van Laar *et al.,* 2022).

The structure of interviews in this study allowed to identify some insights, nevertheless wider interviews or using other questions probably would allow for the discovery also other insights. Nonetheless, the author of the paper expresses the profound hope that the presented study will be valuable and will expand knowledge about digital skills. The reality is more and more complex, dynamic, and ambiguous. Therefore it is valuable to explore urgent topics and rethink approaches to them. A good example of it could be this grant project whereby the development of digital soft skills and advanced technical skills were brought together. Given the above, based on this study it is possible to formulate five main conclusions about developing digital skills:

- It is valuable to develop digital skills including soft skills as well as advanced technical skills.
- Developing digital skills should be improved by a longer time, e.g., during a few months, because this is a process.
- Developing digital skills not solely but working in a team is meaningful
- In developing digital skills valuable is real cooperation with business (based on real projects) to focus on developing digital skills currently needed in business.
- Interdisciplinary and interinstitutional cooperation have huge value in developing digital skills.

Future researches about digital skills are strongly needed and should be conducted. Especially since in 2022, a questionnaire to measure digital skills was published. It includes six factors: access to and management of digital content, use of digital means, communication of digital content, creation of digital content, digital empathy, and digital safety (Fan *et al.,* 2022). In formulating directions of future research on digital skills it is valuable to underline the possibility to analyze digital skills by combining advanced technical skills and digital soft skills. Future research of course also should take into account a wider group of participants. The next recommendation is to analyze digital skills in various sectors of business.

However, the essential for future research will be the recommendation to analyze digital skills, not as a "point" in the reality. To provide valuable research about digital skills it is necessary to understand that developing digital skills is a process. It is demanding and challenging for researchers, however, a process-based approach could bring and provide really valuable findings about developing digital skills.

Certainly, this study does not fully explore developing digital skills. However, the author hopes it will be valuable for future research, especially since developing digital skills is a more and more urgent topic in a more and more digital world.

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