Digital Skills and Online Collaborative Learning: The Study Report

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Abstract: This paper discusses digital skills and their role in collaborative distance learning. Collaboration is considered to be one of the most effective, yet challenging, methods of teaching and learning. Many learners avoid collaborative tasks, for different reasons. We believe that the level of digital skills may be a key to understanding their attitude. A study was conducted at Nicolaus Copernicus University in Toruń, Poland. The respondents assessed, amongst other items, the level of their own digital skills. Based on this assessment, three groups of students with different skill levels were distinguished. Further analyses showed that students with different level of digital skills vary according to their own experiences in collaborative online learning, but not in terms of views on the phenomenon, technologies used, or computer hardware. Most differences are between the low and high skill groups. However, they are also present between the low and average, and the average and high skill groups. These results contribute to the discussion on the need to individualise the teaching and learning process and highlight the roles of digital competence development for all participants in the learning process.

Keywords: digital skills, metacognitive strategies, collaborative learning, e-learning

1. Introduction

Collaboration is considered to be the highest level of group work, in which participants work together to solve a problem. Collaboration processes are increasingly supported by Information and Communication Technology (Wang, 2010). The use of digital technologies can improve the quality of the learning experiences if they are used as a participatory, communicative tool to support collaboration and co-construction of knowledge (Lai, 2011; Sangeetha and Saileela, 2021). Therefore, collaborative online learning is not an exchange of information or cooperation (in which tasks are divided between participants), but involves working together, such as to solve a problem. This not only requires an intensive exchange of thoughts or discussions, but is also more cognitively demanding, and permits the creation of deeper social bonds (Blau, Shamir-Inbal and Avdiel, 2020). Collaboration reveals students' capabilities of self-education and self-improvement, and also allows them to create a positive climate of openness and mutual support as a result of establishing relationships between team members. Based on studies, the Broadband Commission for Sustainable Development's (2017, p. 108) Working Group on Education confirms that currently students demonstrate significantly higher levels of digital collaboration, and their digital skills seem to facilitate such collaboration. Digital collaboration also includes socio-emotional learning dimensions, such as self-management, social awareness and self-efficacy. In addition, collaborative learning fosters a sense of responsibility for the success of actions taken through a better understanding of constructive feedback (Raffone and Monti, 2019) and improved collaboration, relationship and communication skills in student groups (Estriegana, et al., 2021). It is worth emphasising that in this type of learning, particular attention should be paid to the element of participants' interaction, because it is the foundation for building a sense of participation in the group, and it mobilises and strengthens relationships. Aragon (2003) emphasises the importance of providing reassurance to learners so that they feel comfortable working in a group. Hara, Bonk and Angeli (2000), on the other hand, believe that collaborative learning enables greater interaction and dialogue between learners, which fosters a sense of belonging to a group, team or community, reduces student isolation, failure and dropout rates, and increases enthusiasm or motivation. Numerous studies (Davis 1997; Borden and Perkins 1999; Ge, Yamashiro and Lee 2000) have shown that those students who understand their role in a collaborative learning situation learn better. They feel satisfied about having participated in the interaction experience and achieving learning outcomes. The research also confirms the many benefits of collaborative learning, such as cognition through experience (Bauerle and Park, 2012), enhancement of creativity (Ayob, et al., 2012), and improvement of learning skills (Blanco, et al., 2017), including self-study (Wang, Chen and Gao, 2020). Collaborative learning offers a space where learners can share their knowledge, structure their thinking as part of the sharing process and learn from others (Blanco, et al., 2017).

Due to a number of changes, including technological changes and their pace, collaboration is a subject of wider social interest, and in many countries it constitutes the basis for guidelines for solutions in the sphere of, e.g. education (Bellal and Nader, 2014; Brooks, Dau and Selander, 2021). Ragoonaden and Bordeleau (2000, pp. 361-

372) state that collaborative assignments should be an integral part of an online course and be offered at regular intervals. Learners should be encouraged to participate in collaborative work by assigning them collaborative assignments that allow for effective interactions. An appropriate group composition is important, taking into account personal, professional, cultural and academic predispositions. It is hard to disagree with this. However, one of the challenges of online work is to encourage both students and teachers to use collaborative tasks. It is worth emphasising once again that collaboration has undoubted advantages, such as joint construction of knowledge, development of pro-social attitudes and interpersonal skills or a sense of shared responsibility, as well as negotiation and problem solving, or even understanding others and taking different views into account (Pallof and Pratt, 2005), and it is recognised that such an approach ensures better learning outcomes (Hämäläinen, 2012). Nevertheless, online learners – similarly to offline learners – often avoid collaboration-requiring tasks, such as editing other people's works (Blau, Shamir-Inbal and Avdiel, 2020). It also happens that they take part in a group discussion, but their input is insignificant and often conservative (Hämäläinen, 2012; Lee, Wing and Yang, 2020). It seems that one of the reasons may be the fear that their digital skills are inadequate, and that they themselves will not cope and will be criticised.

Complex digital skills, including metacognitive skills, include aspects such as: 1) planning skills, which are based on setting learning goals, collecting the necessary materials before starting learning, determining the time needed to prepare and own knowledge, 2) monitoring skills - thanks to which the attention is directed during the learning process, asking questions about understanding the content, controlling the pace of learning and solving tasks, etc., and 3) the ability to regulate learning, i.e. changing existing learning strategies (Arends, 1994, p. 208-210). The problem of digital skills and their importance in the modern world, and of teacher or adult education in this regard, is widely discussed in the literature (e.g.: Van Dijk and Deursen 2014; Shopova 2014; Martinez-Cerdá, Torrent-Sellens and González-González, 2018; Blau, Shamir-Inbal and Avdiel, 2020). However, digital skills are rarely examined in the context of collaborative distance learning. There is still a lack of integral and objective analyses in relation to higher education. Many analyses focus only on how to design activities and what tools to use to increase engagement and improve learning outcomes, rather than on learners' characteristics (Hadwin and Winne, 2001; Azevedo and Cromley, 2004; Brooks, Dau and Selander, 2021). Moreover, a number of contradictions are noted. The first one concerns problems with the implementation of research results and conclusions into educational activities, arising, inter alia, from the inability to translate the language of science into the language of practice. Other ones are related to the discrepancy between the need to abandon traditional education methods and the level of digital skills of teachers and students or the conditions of using IT in the practice of higher education. Many publications focus on the use of advanced tools, e.g. virtual reality, programming and collaborative games, without considering technological limitations or difficulties faced by participants in the learning process (Laakso, Korhomen and Hakkainen, 2021). Currently, educators more and more often use digital tools to organise remote cooperation of student groups and to develop the latter's digital skills. However, the implementation of remote education in Polish higher education has not proceeded as quickly and efficiently as was expected (which was especially visible during the early weeks of remote work forced by the COVID-19 pandemic), and there were also several doubts expressed regarding students' proficiency in this regard. The modern academic education system, therefore, faces new challenges in developing and improving collaborative learning and digital skills, considering the requirements of education and work. The issues raised are particularly relevant in the context of a growing demand in the labour market for people who can cooperate and have appropriate digital skills, which results in the need to shape and develop a culture of interpersonal relations, cooperation, and use of individual opportunities ensuring educational and, in the future, professional success. This may be important given the need for greater work efficiency, higher income and employability, as well as in everyday life. In addition, digital skills in collaboration are also assumed to be important, for its contribution to people's empowerment, emancipation and self-fulfilment (Punie, 2007).

To sum up, although there are many studies on online collaboration, there is no research that addresses the problem of digital skills (including their subjective assessment by learners) in the context of collaborative online learning. The topicality of the issues undertaken, the emerging contradictions, and the lack of research in this area justify the choice of the research problem. This article tries to fill the abovementioned gap by analysing the literature on the topic and by showing the results of the authors' own research project. The study focuses on 1) presenting a distribution of digital skills among study respondents, 2) showing how level of digital skills is linked with impressions and reactions to collaboration in online learning tasks, 3) offering recommendations on how students and teachers alike can reap the greatest learning benefits of collaborative learning in online environments.

2. Digital skills as the foundation for effective online learning

It can be assumed that digital skills have played a special role in the process of adaptation to the new conditions of solely remote learning and teaching in higher education. The skills are crucial for independent learning, studying, or developing one's own metacognitive competencies. They relate to the critical use of digital technologies for information, communication, collaboration, and problem-solving in all aspects of life (Shopova, 2014). One's digital skills also facilitate the organisation of learning, and ensure better planning, monitoring, control, and assessment of the effects of one's own learning (Blau, Shamir-Inbal and Avdiel, 2020). If learners are more aware of their own learning strategies, they organise their time to learn at their own pace more effectively. Therefore, digital skills are considered to be one of the eight key competencies for lifelong learning (European Commission, 2018; OECD, 2019). In the literature on the subject, digital competencies are differently defined and analysed on the basis of different theoretical frameworks. Three terms concerning this area appear most frequently: digital literacy, competencies, and skills. They are not the same; the differences between them are described in more detail in the literature on the subject (e.g. Duţă and Cano, 2020). In the presented research, the definition of digital skills is based on the document below.

The European Digital Agenda report defines digital skills as a fundamental digital competence that manifests itself through "the skilful and critical use of information society technologies for work, leisure, study and communication" (European Commission, 2012). The European Commission's science and knowledge service (The Digital Competence Framework 2.0, 2019) indicates that a person with this competence should demonstrate such skills as:

1. Using information, which is done by locating and searching for digital data, evaluating the accuracy of the source and its content, and organising information.
2. Communication and collaboration through digital technologies, while being aware of cultural and generational diversity; participation in society through public and private digital services.
3. Creating digital content, integrating information and content with existing knowledge while understanding how copyright and licences are to be applied.
4. Security, protection of devices, content, personal data, and privacy in digital environments; but also protection of physical and mental health, and awareness of how digital technologies serve social welfare and social inclusion.
5. Problem solving: identifying needs and problems, and solving conceptual problems and problem situations in digital environments, as well as metacognitive skills related to, for example, finding one's own digital competence gaps.

The above-mentioned skills constitute a set of intellectual tools that may be important for the sense of self-efficacy, and can thus positively influence the involvement of learners in the learning environment, where they will be able to plan, monitor and regulate their activities (Allan, 2016).

Moreover, metacognitive skills are also important as integral components of digital skills. Learners who can use metacognitive strategies are more aware of and have more control over the learning process (Blau, Shamir-Inbal and Avdiel, 2020). Using them increases the ability to self-evaluate their own work, increases the sense of self-efficacy, and thus enables learners to achieve greater success (Blau, Shamir-Inbal and Avdiel, 2020). Moreover, lack of effective use of cognitive and metacognitive strategies translates into lower achievement of learning outcomes (Kramarski and Gutman, 2006). Interestingly, there is some feedback between digital skills and metacognitive strategies. Specifically, digital skills allow learners to choose a learning strategy that is more suited to their individual needs and abilities, which also results in a better application of metacognitive strategies (Arends, 1994).

3. Digital skills and online collaborative learning – the role of the teacher

Digital skills also support learners in regulating the collaborative learning process, and help them cope with the sense of responsibility for the results obtained (Blau, Shamir-Inbal and Avdiel, 2020). It seems that remote collaborative learning creates conditions for the improvement of digital skills, including the ability to manage one's own learning process and time planning, and thus the monitoring and regulation of this learning process. However, in e-learning, students more often choose individual work; this is due to a lack of need for contact with others, concerns about communication or technical problems, and the fact that they work on the basis of methodological instructions included in the course (Parra, 2016). Such action – i.e. working alone, or even in a group when based on guidance – will often be unproductive (Hämäläinen, 2012). Moreover, research results

indicate that the primary predictor of not dropping out of an online course is the time spent on communication activities. The authors Rienties and Toetenel (2016), after analysing 151 modules and the behaviour of over 110,000 students, noticed that communication plays a key role in academic retention. They suggest – provided that the course learning objectives allow it – that the course assignments include tasks that enable activities such as discussions and the exchange of views. This is especially important given that the quality of learners' communication is related to the quality of learning (Hämäläinen, 2012). Research also shows that simply writing a post or another form of participation in a discussion does not always translate into the quality of cooperation or achievement of goals. It can therefore be assumed that effective collaborative learning is not possible without the active participation of the teacher, through their mentoring or coaching (Blau, Shamir-Inbal and Avdiel, 2020). The teacher must also watch over, for example, an exchange of views or a discussion that occurs in the course, and if necessary, monitor it. Research by Hämäläinen (2012) shows that some students, in order to work effectively in a group, need more support (e.g. detailed instructions, monitoring their activity) in carrying out collaborative tasks.

Hence, the role of the teacher is found to be crucial, in terms of streamlining and supporting the students' learning process. It is important to promote a learning culture, search for reliable sources, respect copyrights, and support learners in improving their own learning strategies (Kwiatkowska, 2018). The appropriate adaptation of teaching materials is also particularly important in promoting active learning (Kwiatkowska, 2018), as is their quality. Therefore, the literature on the subject emphasises the importance of orchestrated learning methods, including collaboration scripts (Hämäläinen, 2012).

Even the most fully described and tested teaching methods may turn out to be insufficient if changes are not made in the attitude of teachers. However, as Hämäläinen (2012) aptly points out, the collaboration process is "a challenging task for teachers" (p. 603). This is due to a lack of support (including institutional support, such as related to the nature of the study programme), reluctance of learners themselves to adopt such activities, or the change in the role that participants of collaborative learning are to play. This last challenge is related to the transformation of the role of the teacher, which many find difficult to accept. From being a person who is a source of knowledge, an authority in their field, the teacher now becomes a moderator responsible for managing the collaborative learning process. The form of communication is also changing: from monological it is becoming dialogical, focused on the exchange of thoughts – not only talking, but also listening. This is often in contradiction to the teacher's individual and social experiences (Sajdak-Burska, 2020), which does not facilitate adaptation to new conditions.

Siemens (2005), the creator and promoter of connectivism, claims that when moving in the digital world, the learner draws from the experiences of other people present in this space. They cannot experience everything themselves, and thus should be able to obtain the knowledge, ideas, and actions of others, through integrating, sharing, enriching themselves and finding recognition among others. In his concept, the author combines the twofold nature of remote learning: independent and community learning. He focuses on the discourse between online community participants who express similar interests and share their opinions and experiences. An analogy can be found here with the theory of situational learning as defined by Lave and Wenger (1991). Siemens (2005) emphasises the importance of self-regulation in enabling learners to achieve their own learning and development goals through, inter alia, using collective knowledge and the ability to create new knowledge. The conclusion is that teachers' control must give way to greater learner autonomy. Members of the learning community must develop mutual trust, support each other, pursue common goals, or take responsibility for their commitment to group learning. To this end, it is necessary to develop effective communication or conflict resolution strategies; and this is not easy, when taking into account, for example, the presentation of many points of view or various perspectives. When dealing with the inflow of information, responsibility for the learning process, including group learning, emphasises the role of self-regulation (Blau, Shamir-Inbal and Avdiel, 2020). The role of the teacher is therefore full of paradox: on the one hand, they are required to support, monitor and motivate; and on the other, to respect the autonomy of the learner.

Garrison and Archer (2007) believe that teachers need to understand that online learning has a unique character, which makes it possible to create a critical learner community, regardless of time and place. In other words, they need to provide new and more efficient learning situations that encourage learners to engage in critical discourse and reflective thinking, and teach them how to learn in this environment, both individually and in collaboration. However, even the greatest advantages of collaborative learning, such as well-chosen teaching methods or a supportive teacher, will not always be able to change students' reluctance regarding active and committed

activities. Despite many years of research on the phenomenon of collaboration, many aspects remain unknown, including what factors make some students reluctant to engage in such tasks. It is hard to disagree with the statement of Lee, Wing and Yang (2020), that "one essential requirement of all students is the capacity to collaborate effectively with peers" (p. 1). However, students themselves do not always collaborate effectively in groups, and they perform their tasks, such as placing discussion posts, only to get a pass for them. Their statements often add little to the topic (Sarja et al., 2018) and do not lead to collaboration, even in tasks designed for such activities (Hämäläinen, 2012). Based on their analysis of the literature on the subject, Lee, Wing and Yang (2020) note that one possible explanation for this is "social loafing". Relying on someone else to do the work on behalf of the group to which one belongs, in turn, causes the frustration and withdrawal of those committed and cooperative learners. Other reasons include socio-cultural barriers and the lack of adequate skills to complete a collaborative task. In our opinion, the latter factor may be of particular importance. The research described below is an attempt to answer the question of whether the subjective assessment of their own digital skills is related to how learners evaluate and work in collaborative online learning.

4. Material and methods

4.1 Objective of the study

The main objective of the research was to identify whether the perception of one's own level of digital skills is related to students' experiences and approach to collaborative distance learning. In connection with the assumed goals, the following research questions were formulated in this study:

First, concerning the state of the variables:

1. What is the distribution of the level of students' self-assessed digital skills?

Second, regarding the relationship between variables:

1. Does the level of students' self-assessed digital skills relate to their approach to collaborative online learning, and how?
2. Does the level of students' self-assessed digital skills relate to the type of technology, the type of videoconferencing system, and computer equipment used in collaborative learning, and to what extent?
3. Does the level of students' self-assessed digital skills relate to their experience (preferences) in collaborative learning, and to what extent?

4.2 Study Design and Data Collection

The research was conducted online through a closed research system. The research group consisted of students of various faculties and specialisations, studying at Nicolaus Copernicus University in Toruń, Poland. The study was conducted in May and June 2020, after students had completed approximately 2–3 months of exclusive distance learning. The respondents received a link and an invitation to participate in the survey via the university's e-mail system. People entering the start page of the research were informed about the purpose of the research, as well as about the method of data processing. Moreover, the students were informed that the research was anonymous, voluntary, and they could resign from it at any time. In order to take part in the survey, interested persons had to give their consent to participate. The start page was viewed over 500 times, but only 163 responses were complete and were included in further analysis.

The selection of the respondents for the sample was purposeful, and the basic criterion was participation in remote university classes. The study used the diagnostic survey method. For this purpose, a questionnaire was constructed, consisting of four groups of questions:

1. Sociodemographic data: gender, age.
2. Assessment of students' own digital online learning skills at the time of the study. Students were offered a definition of digital skills (i.e. free and critical use of digital technologies in educational settings). The respondents could indicate the level of their own skills on a five-point Likert scale (1: very low, to 5: very high). This type of scale is most often used in research because its main advantage is simplicity and usability. It can be concluded that in the case of this study, it will meet the optimization condition and will be sufficient.
3. Applications and tools used in online learning. The respondents could choose any number of the proposed technological solutions. They also had the opportunity to add their own answers.

4. Online collaborative learning: students' own experiences and perception of the phenomenon. Participants were presented with 15 statements about collaborative online learning. Students answered on a five-point Likert scale (1: completely disagree, to 5: completely agree).

The verification of the research tool and the research procedure were performed in a pilot study, which ensured the identification of errors, shortcomings and ambiguities. Based on the information obtained, some items in the survey form were redrafted, changed or deleted.

4.3 Results

The analysis of the test results was performed using the PS Imago Pro Academic 6 program (SPSS for Windows, version 26). The first step was to divide the respondents into three groups depending on their own subjective assessment of their digital skills. The respondents chose answers on a Likert scale, where 1 meant very low competence, and 5 indicated very high. The group was divided as follows:

- Group 1 was composed of a total of 30 people, including four who assessed their skills as very low, and 26 who assessed their skills as low.
- Group 2 consisted of 62 people who assessed their skills as average.
- Group 3 comprised 71 people in total, including 60 with high skills and 11 students who assessed their skills as very high.

Main demographic data about the groups are presented in Table 1. The next step was to look for differences in perceptions and experiences related to collaborative learning via the Internet.

Table 1: Basic data about the groups of respondents

		All groups (N=163)		Gr. 1 Low (N=30)		Gr.2 Average (N=62)		Gr.3 High (N=71)	
		N	%	N	%	N	%	N	%
Gender	M	43	26.4	9	30	15	24.2	19	26.8
	F	120	83.6	21	70	47	75.8	52	73.2
Age group	18–20	49	30.2	9	30.0	17	27.4	20	28.2
	21–30	107	65.6	18	60.0	41	66.2	48	67.6
	31–40	4	2.5	3	10.0	2	3.2	2	2.8
	41–50	2	1.2	-	-	2	3.2	-	-
	Over 50	1	0.5	-	-	-	-	1	1.4

The analysis of the data contained in Table 2 shows that the groups do not differ statistically significantly in the tools they use in collaborative online learning. In all groups, the most popular were social networking sites, Internet messaging, and Google applications (this group includes, for example, text or presentation documents). Interestingly, the Moodle workshop (a solution available as part of the university's e-learning support system, enabling the submission of papers and their subsequent assessment by other participants and the teacher) was used by about one-third of students.

Table 2: Distribution of numerical and percentage indicators by the level of digital skills, indicating the type of technology used in collaborative learning

What are you using for collaborative learning?	All groups (N=163)		Gr. 1 Low (N=30)		Gr.2 Average (N=62)		Gr.3 High (N=71)		χ^2	V_C
	N	%	N	%	N	%	N	%		
Google	75	46.0	13	43.3	27	43.5	35	49.3	0.546	0.058
Wiki	22	13.5	4	13.3	8	12.9	10	14.1	0.040	0.016
Moodle workshop	62	38.0	10	33.3	23	37.1	29	40.8	0.542	0.058
Internet messengers	110	67.5	23	76.7	38	61.3	49	69.0	2.312	0.119
Social networks	126	77.3	20	66.7	50	80.6	56	78.9	2.429	0.122

The respondents most often pointed to the use of the Microsoft Teams videoconferencing system in collaborative learning. Subsequently, Discord and Zoom were indicated (Table 3).

Table 3: Distribution of numerical and percentage indicators by the level of digital skills, indicating the type of videoconference system used collaborative learning

What are you using for collaborative learning?	All groups (N=163)		Gr. 1 Low (N=30)		Gr.2 Average (N=62)		Gr.3 High (N=71)	
	N	%	N	%	N	%	N	%
Discord	5	3.1	-	-	2	3.2	3	4.2
Docer	1	0.6	1	3.3	-	-	-	-
Big Blue Button	-	-	1	3.3	-	-	-	-
Skype	1	0.6	-	-	-	-	1	1.4
Slack	1	0.6	-	-	1	1.6	-	-
Teams	9	5.5	1	3.3	3	4.8	5	7.0
Zoom	3	1.8	1	3.3	-	-	2	2.8

The observed differences were not found to be significant with regard to what technologies are used for collaborative learning (Table 4). It is worth noting that the most respondents specified mobile tools.

Table 4: Distribution of numerical and percentage indicators by the level of digital skills, indicating the type of computer equipment used for self-study

	All groups (N=163)		Gr. 1 Low (N=30)		Gr.2 Average (N=62)		Gr.3 High (N=71)		χ^2	V_C
	N	%	N	%	N	%	N	%		
Smartphone	52	31.9	11	36.7	22	35.5	19	26.8	1.544	0.097
PC	27	16.6	3	10.0	13	21.0	11	15.5	1.937	0.107
Laptop	147	90.2	27	90.0	55	88.7	65	91.5	0.303	0.043
Tablet	3	1.8	1	3.3	-	-	2	2.8	1.907	0.108

The next step was to look for differences in respondents' opinions and experiences regarding collaborative learning. The analysis of the data contained in Table 5 shows that there are several differences between the separate groups, related to the learners' own experiences. People who rate their digital skills as high (group 3) are more active and committed, are not afraid to express their own opinion and participate more fully in collaborative online learning tasks, compared to respondents with both low (group 1) and average (group 2) skills. The described differences also exist between respondents with low and average competences. These differences are not only statistically significant, but account for 12.6% to 27.5% of the variance between the groups.

Moreover, people convinced that their skills are high are less afraid of making mistakes and are more willing to contribute to the group's work. They also find that online collaborative tasks take less time than offline tasks. The described differences exist between the low-skilled group (group 1) and the high-skilled group (group 3). On the other hand, the willingness to share, including via social media, is at the same level in individuals from the groups with average and high competences. It is also statistically significantly higher than that of the low-skilled group. It is also worth noting that people belonging to each group value a clear division of the tasks and a clear definition of what each person is to do.

The analysis of the data concerning opinions on collaborative learning (Table 6) shows that the respondents, regardless of their level of digital skills, have similar views. It is worth noting that they agree that activities requiring collaboration – including those related to, for example, peer review of one's own work – are relatively rare.

Table 5: Views on students' own experiences of online collaborative learning in different groups

Statement		All	Gr. 1 Low	Gr.2 Average	Gr.3 High	ANOVA		Post-hoc Tukey test		η^2 %
		(N=163)	(N=30)	(N=62)	(N=71)			p	types	
By implementing educational team tasks using the Internet, I am an active and committed person.	M	3.52	2.57	3.32	4.08	F	26.415	0.002 0.000 0.000	1-2 1-3 2-3	24.8
	SD	1.14	0.94	1.10	0.92	p	0.000			
I prefer editing and correcting the work (documents) of other people than commenting and sharing tips.	M	2.75	2.67	2.84	2.72	F	0.361	-	-	0.4
	SD	1.12	0.94	1.06	1.03	p	0.698			
I am more willing to communicate with other people (e.g. via online messaging) than exchange documents.	M	3.57	3.63	3.45	3.65	F	0.690	-	-	0.9
	SD	1.01	1.22	0.97	0.96	p	0.503			
I am happy to share my ideas with others during my studies, also using social media.	M	3.55	2.97	3.68	3.68	F	6.759	0.003	1-2	7.8
	SD	0.99	1.25	0.92	0.84	p	0.002	0.002	1-3	
When I work online with others on a task, I have the courage to express my opinion/view via the Internet.	M	3.82	3.20	3.74	4.15	F	11.524	0.026	1-2	12.6
	SD	0.99	1.19	0.94	0.79	p	0.000	0.000 0.031	1-3 2-3	
If it is clear what I have to do and I know what my contribution to the online task is, I am more ready to work with others.	M	4.21	4.07	4.21	4.28	F	0.948	-	-	1.2
	SD	0.72	0.91	0.63	0.70	p	0.390			
I demonstrate a high level of participation in online collaborative learning.	M	3.27	2.50	3.06	3.77	F	30.293	0.005	1-3	27.5
	SD	0.93	0.82	0.90	0.68	p	0.0001	0.000 0.000	1-2 2-3	
If I could remain anonymous, I would be more willing and more likely to express my opinion and evaluate other projects.	M	3.15	3.17	3.29	3.03	F	0.908			1.1
	SD	1.12	1.21	1.14	1.07	p	0.405			
I hesitate to add my own contribution for fear of being criticised or misleading group members (learning community).	M	2.74	3.20	2.76	2.52	F	3.285	0.031	1-3	3.9
	SD	1.24	1.16	1.29	1.18	p	0.040			
If I were to perform the same tasks by collaborating with others outside the Internet, I would have to spend more time and energy.	M	3.14	2.63	3.16	3.33	F	4.005	0.015	1-3	4.8
	SD	1.15	1.13	1.10	1.15	p	0.020			

Table 6: Views on online collaborative learning in different groups

Statement		All	Gr. 1 Low	Gr.2 Average	Gr.3 High	Anova		Post-hoc Tukey test		η^2%
		(N=163)	(N=30)	(N=62)	(N=71)			p	types	
Modern remote technologies enable learning experiences based on collaboration between learners.	M	3.61	3.27	3.63	3.75	F	2.715	-	-	3.3
	SD	0.96	1.1	0.91	0.92	p	0.069			
When I analyse all the tasks I do while learning online, the collaborative ones are by far the most time-consuming.	M	3.50	3.30	3.39	3.69	F	2.069	-	-	2.5
	SD	1.06	1.21	1.05	0.98	p	0.130			
A significant part of all online activities are activities that require interaction with others.	M	2.50	2.17	2.71	2.45	F	2.792	-	-	3.4
	SD	1.07	0.91	1.22	0.95	p	0.064			
Tasks for learners in e-learning that involve peer review of their work in a course are definitely a rarity in online education.	M	3.91	4.03	3.85	3.92	F	0.339	-	-	0.4
	SD	0.97	0.69	1.02	1.04	p	0.713			

Statement		All	Gr. 1 Low	Gr.2 Average	Gr.3 High	Anova		Post-hoc Tukey test		η^2%
		(N=163)	(N=30)	(N=62)	(N=71)			p	types	
The quality of the work results is higher if the work is the result of cooperation.	M	3.14	2.90	3.26	3.14	F	1.233	-	-	1.5
	SD	1.03	0.96	1.02	1.05	p	0.294			

4.4 Discussion

Three elements play a significant role in collaborative online learning: well-prepared teaching materials; a supportive, dialogical teacher; and committed students (cf. Kwiatkowska, 2018). It can be assumed that the quality of the effects achieved will depend on the weakest link in this feedback. Many publications and studies are devoted to teaching materials, aiming to find the most effective solution in achieving educational results (cf. Schlosser and Anderson, 1994; Holmberg, 2007; Moore, 2007 Allen and Sites, 2012). Therefore, it is worth focusing on the other two elements of the process, paying attention to the "human face" of collaborative distance learning (DeBrock, Scangoli and Taghaboni-Dutta, 2020).

In summarising the results of the conducted research, it can be noticed that the assessment of students' own digital skills as low translates into lower activity of learners, their lower involvement (including reluctance to share their own ideas or to use social media), as well as a greater fear of sharing ideas. Several results seem to be surprising. First of all, regardless of the subjective assessment of their own level of digital skills, students do not differ in what type of technology or type of computer equipment they use. Moreover, what is more interesting, the described differences occur only in relation to the participants' own experiences and not their views on collaborative distance learning. The analysis of the latter shows that the tasks requiring collaboration are still rarely used in the courses. Moreover, students believe that they require more time, but are not entirely convinced that their contribution translates into better learning outcomes. The obtained data is an important indicator in the discussion on the importance of highlighting the benefits of collaborative distance learning and building a positive experience in this regard.

The analysed results are in contradiction with the data from the report of the Statistics Poland (2020), according to which as many as 63.9% of Internet users aged 16 to 24 have more than average digital skills, and only 9% - low. As previously emphasised, general digital skills may not translate into effective online learning, especially in collaboration. The obtained results may also indicate some students' poor preparation for the conscious use of modern technologies as a tool for intellectual work. Even though young people interact in the digital world every day, this does not necessarily cause an increase in their digital skills. As Josefsson and colleagues (2015) note, learners use, for example, social media in three roles: the Student, the Private, and the Professional Role. Researchers (Josefsson et al., 2015; Allan, 2016) suggest that the role of the university is to educate students on how to use available technologies for learning. At the same time, it should be noted that despite the positive changes in access to the Internet and the high adaptability of learners to constantly changing conditions, research and analyses (Carr, 2013; Spitzer, 2013) indicate not only the apparent coordination of many activities, reduced split attention and a lower capability of solving problems in a short time, but also the lack of the ability to critically use new technologies for learning and entertainment. Therefore, it cannot be assumed that students already have digital skills that allow them to study effectively. In the absence of them, they become only passive recipients of information, which translates into their inactivity or commitment. Of course, one could search for other psychological characteristics, including personality traits responsible for this state of affairs; but such actions, although justified from a scientific point of view, would not be possible in practice. An academic teacher would not be able – even with the appropriate knowledge – to analyse the personality profiles of several dozen or several hundred students, and choose the most appropriate way of working with each student.

Is the key to greater learner involvement, then, researching and developing digital skills in the context of collaborative distance learning? Or is this too simplistic? Richards and Pilcher (2020) raise an important problem in their text: namely, whether study skills are not Tinkerbell – a panacea, solution to all students' problems, and whether the focus on their development actually results in, for example, achieving better learning outcomes. We can ask a similar question: Does it make sense to focus on digital skills, and will focusing on their development translate into better functioning in a collaborative learning environment? The answer to this question is complex. In our research, we took into account the subjective assessment of skills; we did not study their objective indicator, because in our opinion, it is not technical skills (which are part of digital skills and which are easy to

assess), but metacognitive skills (much more difficult to assess, such as the ability to critically analyse), which can prove crucial. Therefore, we do not propose a simple solution in the form of increasing skills, but advise mindfulness and openness of the student, and their adoption of ideas that may help them adapt to a collaborative distance-learning environment. We believe – although we are aware that this view may be controversial (cf. Richards and Pilcher, 2020) – that the development of digital skills may also take place during remote work. We also agree with the views of Lee, Wing and Yang (2020) on the special role of self-efficacy (cf. Pintrich and de Groot, 1990) and teacher support, especially in the early stages of coursework. Appropriate supervision, monitoring and correction of activities, as well as the permission to relate to one's own experiences, are particularly important in building the internal motivation of learners. They can increase their self-efficacy, to achieve higher self-esteem and greater commitment.

It is worth emphasising, however, that the above activities are not possible without the active participation of the second important element of the puzzle: namely, academic teachers, from whom increased effort is required (Garrison and Anderson 2003; Hämäläinen, 2012). It is necessary not only to prepare educators to conduct online classes aimed at improving digital skills and cooperation among students, especially in their first years of study, but also to notice that a well-prepared e-learning course requires a significant amount of work, exceeding the hours devoted to its offline equivalent. The reluctance of academic teachers to become more involved in the online didactic process may be dictated, for example, by the lack of appropriate gratification and, paradoxically, by their own digital skills. In Poland – and, we suppose, in many other countries – the role of an academic teacher is unique: on the one hand, he/she is a teacher; and on the other, a scientist. Recent changes (including legal ones) have shifted attention to the latter role: thus, in many cases, the evaluation of work is based primarily on scientific achievements (e.g. research grants obtained, and publications written). Moreover, in the Polish reality, an academic teacher is often left without support (especially long-term support) regarding didactics, and they themselves have never received formal training in this field. Hence, they often draw from their own experiences or follow the well-trodden path set by more experienced colleagues. Years of work or scientific proficiency are supposed to result in being a good educator; yet this assumption in many cases turns out to be fallacious. Lack of support in the field of teaching (including, for example, presenting research results and translating them into the language of a given discipline) means that teachers often learn attitudes and values that in online collaborative learning do not guarantee the achievement of learning outcomes, or do not support learners (Sajdak-Burska, 2020) – for instance, a lack of dialogue, or too much distance from learners. The motivation for developing the professional practice of researchers in the use of technology is not only the need to raise their technological competence, but also to implement the concept of teaching and learning (Kirkwood and Price, 2013).

Therefore, it seems that the control of the level of digital skills (the subjective ones) may allow the teacher to adjust the working methods to the participants (e.g. through individualisation of support, appropriate division of students into groups, etc.). However, it cannot be assumed that this will solve all the difficulties in collaborative distance learning.

5. Conclusions

Entire generations of young people interact with digital media with ever greater intensity. We know that these experiences have a bearing on the world they perceive, the values they present, or the opinions they express. In the situation of distance learning in higher education, we are dealing with enormous opportunities, but also dangers. To help this generation learn to use technology wisely, it is of vital importance that the teachers themselves first understand the potential and threats of these solutions, and be able to use them for the proper guidance and individual and social development of young people, also in the sphere of education. The COVID-19 pandemic has changed the use of technology in teaching, also in the field of higher education, and it can be expected that the role of online solutions will be even more significant than before. As highlighted earlier, it cannot be assumed that young people have the relevant digital skills essential to educational success just because they are surrounded by or actively using modern technologies.

One more point worth highlighting is that distance learning, including distance collaborative learning, "done right (…) is surprisingly intimate" (DeBrock, Scangoli and Taghaboni-Dutta, 2020). It enters the homes of students and university teachers, it robs them of their privacy, and makes some of them extremely vulnerable. Perhaps it is important to be aware of this. It seems that it is the development of digital skills and metacognitive skills of all participants in the education process that allows for better coping with potential threats, and makes it possible to realise the advantages and limitations of collaborative online learning. It can therefore be assumed that thanks

to better digital skills, students will be more engaged and cooperative, also because their fear of violating privacy will be reduced.

Naturally, the research presented in this article is not without its limitations. Firstly, it was not skills that were researched, but their subjective assessment. It can be assumed that there are variables that may influence the assessment such as, for example, self-confidence, self-esteem, self-efficacy, susceptibility to social approval or other characteristics (e.g., personality). It would be worth considering them in future projects. The use of tools that ensure greater precision or neutrality also seems important.

It is obvious that the presented own research does not cover all the problems related to the use of digital skills in collaborative learning. Interesting topics for further research could include assessment of the didactic effectiveness of collaborative learning, analysis of the relationship between the level of digital skills and the use of IT tools, development of cooperation models constituting the basis for improving the organisation of these activities and their implementation into practice, or last but not least a study of the nature, development of communication and interaction in collaborative learning.

It would also be worth undertaking further research monitoring the level of teaching of digital skills in cooperation in adult courses and academic education, but above all at a school level, where they are initiated and shaped at a fairly early stage of life. It is worth taking care of preparing teachers to educate and develop the discussed skills also among students.

It should be remembered that there are still few reports on research conducted in this area in Poland. Certainly, the conclusions drawn from the presented research should be taken into account and be gradually verified.

References

Allan, B., 2016. Emerging strategies for supporting student learning: A practical guide for librarians and educators. London: Facet Publishing.

Allen, M., and Sites, R., 2012. Leaving ADDIE for SAM.. Faster, better learning product development. Alexandria: Association for Talent Development.

Aragon, S. R., 2003. Creating social presence in online environments, New Directions for Adult and Continuing Education, [e-journal] 100, pp. 60. https://doi.org/10.1002/ace.119.

Arends, R. I., 1994. Uczymy się nauczać [We learn to teach]. Warszawa: Wydawnictwa Szkolne i Pedagogiczne.

Ayob, A., Majid, R.A.; Hussain, A. and Mustaffa, M.M., 2012. Creativity enhancement through experiential learning. Advances in Natural and Applied Sciences, 6 (2), pp. 94–99. [pdf] Available at: <https://www.academia.edu/2154034/Creativity_Enhancement_Through_Experiential_Learning> [Accessed 10 May 2022].

Azevedo, R. and Cromley, J. G., 2004. Does training of self-regulated learning facilitate student's learning with hypermedia?, Journal of Educational Psychology, [e-journal] 96(3), pp. 523-535. https://doi.org/10.1037/0022-0663.96.3.523.

Bauerle, T.L. and Park, T.D., 2012. Experiential learning enhances student knowledge retention in the plant sciences. HortTechnology, [e-journal] 22, pp. 715–718. https://doi.org/10.21273/HORTTECH.22.5.715..

Bellal, M. and Nader, F., 2014. „E-shop": A collaborative learning activity, Procedia – Social and Behavioral Sciences, [e-journal] 152, pp. 214-218. https://doi.org/10.1016/j.sbspro.2014.09.183.

Blanco, M.; Gonzalez, C.; Sanchez-Lite, A. and Sebastian, M.A., 2017. A practical evaluation of a collaborative learning method for engineering project subjects. IEEE Access, 5, pp. 19363–19372.

Blau, I., Shamir-Inbal, T., and Avdiel, O., 2020. How does the pedagogical design of a technology-enhanced collaborative academic course promote digital literacies, self-regulation, and perceived learning of students?, The Internet and Higher Education, [e-journal] 45, pp. 1-11. https://doi.org/10.1016/j.iheduc.2019.100722.

Borden L. M. and Perkins D. F. 1999, Assessing your collaboration: A self-evaluation tool, Journal of Extension, [e-journal] 37 (2). http://joe.org/joe/1999april/tt1.html.

Brooks, E., Dau, S. and Selander, S. eds., 2021. Digital learning and collaborative practices. Lessons from inclusive and empowering participation with emerging technologies. New York and London: Routledge. Taylor & Francis Group.

Carr, N. G., 2013. Płytki umysł: jak internet wpływa na nasz mózg [Shallows - what the internet is doing to our brains]. Gliwice: Wydawnictwo Helion.

Davis A. 1997, Arizona non-profit collaboration manual. PARTNERS. [online] Available at: <http://www.azpartners.org/collaborationManual.asp>[Accessed 9 May 2022].

DeBrock, L., Scangoli, N. and Taghaboni-Dutta, F., 2020. The human element in online learning. [online] Available at:<https://www.insidehighered.com/advice/2020/03/18/how-make-online-learning-more-intimate-and-engaging-students-opinion> [Accessed 12 March 2022].

Duţă, N. and Cano, E., 2020. Digital teacher competences: main lesson and future challenges, Proceedings of the 16th International Scientific Conferences "eLearning and Software for Education". [online] 1, pp. 319-326. https://doi.org/10.12753/2066-026X-20-041.

European Commission, 2018. Council Recommendation 22 May 2018 on key competences for lifelong learning. [online] Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN> [Accessed 12 March 2022].

European Commission, 2012. Digital competences in the digital agenda. [online] Available at: <https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/scoreboard_digital_skills.pdf> [Accessed 12 March 2022].

Estriegana, R., Medina-Merodio, J.-A., Robina-Ramírez, R. and Barchino, R., 2021, Analysis of Cooperative Skills Development through Relational Coordination in a Gamified Online Learning Environment. Electronics, [e-journal] 10, pp. 2032. https://doi.org/10.3390/electronics10162032.

Garrison, D. R. and Anderson, T. 2003, E-learning in the 21st century. A framework for research and practice, New York, London: RoutledgeFalmer.

Garrison, D. R. and Archer, W., 2007. A theory of community of inquiry. In: M. G. Moore, ed. 2007. Handbook of distance education. New Jersey: Lawrence Erlbaum Associates.

Ge X., Yamashiro K. A. and Lee J., 2000, Pre-class planning to scaffold students for online collaborative learning activities, Educational Technology & Society, [e-journal] 3 (3), Available at:<http://ifets.ieee.org/periodical/vol_3_2000/b02.html>[Accessed 12 March 2022].

Hadwin, A. F. and Winne, P. H., 2001. CoNoteS2: A software tool for promoting self-regulation, Educational Research and Evaluation, [e-journal] 7, pp. 313-334. https://doi.org/10.1076/edre.7.2.313.3868.

Hara, N., Bonk, C.J. and Angeli, C., 2000. Content analysis of online discussion in an applied educational psychology course. Instructional Science, [e-journal] 28, pp. 115–152 . https://doi.org/10.1023/A:1003764722829

Hämäläinen, R., 2012. Methodological reflections: designing and understanding computer-supported collaborative learning, Teaching in Higher Education, [e-journal] 17(5), pp. 603-614. https://doi.org/10.1080/13562517.2012.658556.

Holmberg, B., 2007. A theory of teaching-learning conversations. In: M. G. Moore, ed. 2007. Handbook of distance education. New Jersey: Lawrence Erlbaum Associates.

Josefsson, P., Hrastinski, S., Pargman, D., and Pargman, T. C., 2015. The student, the private and the professional role: students' social media use, Education and Information Technologies, [e-journal] 21, pp. 1583-1594. https://doi.org/10.1007/s10639-015-9403-7.

Kirkwood, A. and Price, L., 2013. Missing: evidence of a scholarly approach to teaching and learning with technology in higher education, Teaching in Higher Education, [e-journal] 18(3), pp. 327-337. https://doi.org/10.1080/13562517.2013.773419

Kramarski, B. and Gutman, M., 2006. How can self-regulated learning be supported in mathematical e-learning environments?, Journal of Computer Assisted Learning, [e-journal] 22(1), pp. 27-33. https://doi.org/10.1111/j.1365-2729.2006.00157.x.

Kwiatkowska, W., 2018. Mozaikowy wizerunek uczących się w uniwersyteckim kształcenia zdalnym [A mosaic image of learners in university online education]. Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.

Laakso, N. L., Korhonen, T. and Hakkarainen, K. P. J. 2021. Developing students' digital competences through collaborative game design. Computers & Education, [e-journal] 174, pp.1-15. https://doi.org/10.1016/j.compedu.2021.104308.

Lai, K.-W., 2011. Digital technology and the culture of teaching and learning in higher education. Australasian Journal of Educational Technology, [e-journal] 27(8), pp. 1263-1275. https://doi.org/10.14742/ajet.892

Lave, J. and Wenger, E., 1991. Situated learning. Legitimate peripheral participation. Oxford: Cambridge University Press.

Lee, W., Wing, S. and Yang, M., 2020. Effective collaborative learning from Chinese students' perspective: a qualitative study in a teacher-training course, Teaching in Higher Education, [e-journal] https://doi.org/10.1080/13562517.2020.1790517.

Martínez-Cerdá, J-F., Torrent-Sellens, J. and González-González, I., 2018, Promoting collaborative skills in online university: comparing effects of games, mixed reality, social media, and other tools for ICT-supported pedagogical practices. Behaviour & Information Technology, [e-journal] 37 (10-11), pp. 1055-1071, https://doi.org/10.1080/0144929X.2018.1476919.

OECD, 2019. Education at a glance 2019: OECD Indicators. Paris: OECD Publishing. https://doi.org/10.1787/f8d7880d-en.

Pallof, R. M. and Pratt, K. 2005. Collaborating online. Learning together in community. San Francisco: Jossey-Bass.

Parra, B. J., 2016. Learning strategies and styles as a basis for building personal learning environments, International Journal of Educational Technology in Higher Education, [e-journal] 13 (1), pp.1-11, Available at: <http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=2&sid=0c4055d4-7575-4df8-a644-7696de27c432%40sessionmgr4008&hid=4205> [Accessed 12 March 2022].

Pintrich, P. R. and de Groot, E. V., 1990. Motivational and self-regulated learning components of classroom academic performance, Journal of Educational Psychology, [e-journal] 82(1), pp. 31-40. Available at: <https://pdfs.semanticscholar.org/043f/f84ba6c35fdcd9103894cb2e988cc15ea886.pdf> [Accessed 12 March 2022].

Punie, Y., 2007. Learning Spaces: An ICT-enabled model of future learning in the knowledge-based society, European Journal of Education, [e-journal] 42(2), pp. 185–199. https://doi.org/10.1111/j.1465-3435.2007.00302.x.

Raffone, A. and Monti, J., 2019. Becoming storytellers: improving ESL students' academic engagement and 21ST Century skills through interactive digital storytelling, 16th International Conference on Cognition and Exploratory Learning in Digital Age, [pdf] https://doi.org/10.33965/celda2019_201911L020.

Ragoonaden K. and Bordeleau, P. 2000, Collaborative Learning via the Internet, Journal of Educational Technology and Society, [e-journal] 3(3), pp.361-372, Available at: <https://www.researchgate.net/publication/220374029_Collaborative_Learning_via_the_Internet> [Accessed 12 March 2022].

Richards, K. and Pilcher, N., 2020. Study skills: neoliberalism's perfect Tinkerbell, Teaching in Higher Education. [e-journal] https://doi.org/10.1080/13562517.2020.1839745.

Rienties, B. and Toetenel, L., 2016. The impact of learning design on student behaviour, satisfaction and performance: A cross-institutional comparison across 151 modules. Computers in Human Behavior, [e-journal] 60, pp. 333-341. https://doi.org/10.1016/j.chb.2016.02.074.

Sajdak-Burska, A., 2020. Edukacja dla przyszłości. Konieczność profesjonalizacji roli nauczyciela akademickiego [Education for the future. The need to professionalize the role of an academic teacher], Forum Akademickie, [e-journal] 7-8. Available at: <https://miesiecznik.forumakademickie.pl/czasopisma/fa-7-8-2020/edukacja-dla-przyszlosci/> [Accessed 12 March 2022].

Sarja, A., Janhonen, S., Havukainen, P. and Vesterinen, A., 2018. Towards practical reflexivity in online discussion groups, Teaching in Higher Education, [e-journal] 23(3), pp. 343-359. https://doi.org/10.1080/13562517.2017.1391197.

Shopova, T., 2014. Digital literacy of students and its improvement at the university, Journal on Efficiency and Responsibility in Education and Science, [e-journal] 7(2), pp. 26-32. https://doi.org/10.7160/eriesj.2014.070201.

Schlosser, Ch. A. and Anderson, M. L., 1994. Distance education: review of the literature. Washington: Research Institute for Studies in Education. [pdf] Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.934.7231&rep=rep1&type=pdf >[Accessed 12 March 2022].

Siemens, G., 2005. Connectivism: A learning theory for the digital age, International Journal of Instructional Technology and Distance Learning, [e-journal] 2(1), pp. 3-10. Available at: <https://jotamac.typepad.com/jotamacs_weblog/files/Connectivism.pdf>[Accessed 12 March 2022].

Spitzer, M., 2013. Cyfrowa demencja. W jaki sposób pozbawiamy rozumu siebie i swoje dzieci [Digital dementia: What We and Our Children are Doing to our Minds]. Słupsk: Wydawnictwo Dobra Literatura.

Statistics Poland, 2020. Information society in Poland in 2020. [online] Available at: <https://stat.gov.pl/en/topics/science-and-technology/information-society/information-society-in-poland-in-2020,1,7.html> [Accesed 12 March 2022].

Van Dijk J. A. G. M. and Van Deursen A. J. A. M., 2014. Digital skills. Unlocking the information society. New York: Palgrave Macmillan.

The Digital Competence Framework 2.0., 2019. The European Commission's science and knowledge service. [online] Available at: <https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework>[Accessed 12 March 2022].

Wang, J.; Chen, X. and Gao, X., 2020. Economic Management Teaching Mode Based on Mobile Learning and Collaborative Learning. IEEE Access, [e-journal] 8, pp. 200589–200596. https://doi.org/10.1109/ACCESS.2020.3033774.

Wang, Q., 2010. Using online shared workspaces to support group collaborative learning. Computers & Education, [e-journal] 55(3), pp. 1270–1276. https://doi.org/10.1016/j.compedu.2010.05.023.

