Knowledge Management & E-Learning, Vol.14, No.3. Sep 2022

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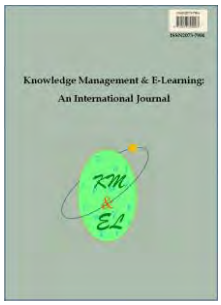

Knowledge Management & E-Learning: An International Journal (KM&EL)
ISSN 2073-7904

Recommended citation:
Tomczyk, Ł., Demeshkant, N., Potyrała, K., Czerwiec, K., & Oyelere, S. O. (2022). Elements of crisis e-learning: Perspectives of Polish teachers. *Knowledge Management & E-Learning, 14*(3), 245–268. https://doi.org/10.34105/j.kmel.2022.14.014

Knowledge Management & E-Learning, 14(3), 245–268

Elements of crisis e-learning: Perspectives of Polish teachers

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Abstract: The aim of the research was to investigate teachers' perspectives on the elements of emergency e-learning during the COVID-19 pandemic. The research was conducted with 134 teachers from different types of schools in Poland during the first wave of crisis e-learning (March - May 2020). The variables included in the analysis comprise teachers' use of differentiated teaching methods, student collaboration, school support for modern ICT, and teachers' digital competence. The findings are summarized as follows: (1) about a third of students did not develop the ability to work together in emergency e-learning; (2) more than two-thirds of teachers underlined that their schools actively promoted the idea of implementing ICT in education; (3) more than two-thirds of teachers emphasized that their school principals had systematically modernized the IT facilities necessary for effective teaching; (4) approximately half of the teachers were supported by the school authorities in strengthening their digital competence; and (5) teachers used various teaching

methods in emergency e-learning, and the most popular methods were videos, presentations, e-learning platforms, and interactive games and applications; (6) teachers who did not differentiate digital teaching methods did not believe in the development of opportunities for soft skills among students; (7) the schools invested in technological facilities and supported the development of digital competence among teachers; and (8) the intensive use of e-learning platforms by teachers increased their positive attitude towards the development of soft competences (e.g., collaboration skills) among students.

Keywords: e-Learning; Pandemic; School support; Teaching methods; Student collaboration; Poland

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1. Introduction

The spread of SARS-CoV-2 has led to profound changes in social interaction, and the education sector was no exception. The COVID-19 crisis had far-reaching implications, and involved the lockdown of schools in March 2020 in many countries around the world. As few countries had experienced a pandemic that would cause a social crisis before, the knowledge of how to deal with the situation and the challenges posed by digital learning in this context were limited (Huber & Helm, 2020; Larmuseau, Desmet, & Depaepe, 2019). The precautionary measure known as "social distancing" aimed to limit interpersonal contact and thus minimize the transmission of the virus. In the context of primary and secondary school, this transmission would rapidly develop in the communities such as school buildings and individual classrooms. Public health experts recognized that in the absence of a vaccine or effective form of treatment for the virus, the overall threat of COVID-19 was best handled by social distancing measures, and so the e-learning protocol was put into effect to limit direct classroom interactions. Emergency e-learning programs, where face-to-face teaching was moved online, were identified as the most appropriate emergency response measure, especially given how the continuation of normal school practices would have introduced great uncertainty (Murphy, 2020; Weeden & Cornwell, 2020; Aguilera-Hermida, 2020).

COVID-19 has largely eliminated the teacher's direct control of the students' active learning. Instead, it has brought to the fore the self-regulation, volitional, and motivational abilities of students. The literature emphasizes the importance of the students' acceptance and self-assessment in relation to digital media. The social context appears to be important for the development of volitional competences. Teachers face many challenges related to physical distance and the limited opportunities they have to connect with their students (Huber& Helm, 2020; Larmuseau, Desmet, & Depaepe, 2019). Nowadays, research can help describe the COVID-19 crisis and analyse its implications for schools and education (Huber & Helm, 2020). The school not only fulfils the educational mission of knowledge transfer, but also meets the socialization needs of young people. When students are at home, the school community is reduced, and despite the virtual interactions and learning opportunities offered by the internet and social networks, a barrier is created in the educational relationship between students. In addition, young people lack physical space where they can share their interests, hopes and emotions. The school provides an organized environment in which young people can learn and develop social competences such as self-confidence, friendship, empathy, participation, respect, gratitude, compassion and responsibility. Promoting student well-being is closely related to school achievement (Colao, Piscitelli, Pulimeno, Colazzo, Miani, & Giannini, 2020; Zins, Bloodworth, Weissberg, & Walberg, 2007). This difficult time called for extraordinary measures - one of the most commonly used was the application of the emergency e-learning protocol. The use of emergency e-learning in March 2020 differed from the implementation of e-learning based on fully appropriate methodologies.

The phenomenon of crisis e-learning in Polish universities involved five stages: 1 / the suspension of classes, chaos, the need to go beyond familiar patterns; 2 / the attempt to select and adjust teaching tools; 3 / the search for various forms of support in the field of self-education; 4 / the beginning of stabilization and the search for hardware and software solutions as well as increased attention paid to the optimal working conditions of students, including interpersonal contact; 5 / intensive work on the preparation of teaching materials in digital form and drawing conclusions from the activities (Klimowicz, 2020). In this context, the effective use of technology allows students and teachers to engage and work with each other. The successful transition to online learning depends on the intention of the user and the application of the technology. Adopting the online learning environment is not just a technological issue, but a pedagogical and instructional challenge (Aguilera-Hermida, 2020; Ali, 2020; Gonzalez, de la Rubia, Hincz, Lopez, Subirats, Fort, & Sacha, 2020; Bower, 2019; Kemp, Palmer, & Strelan, 2019). During the pandemic, students found themselves involved in the online system without any due preparation, and their motivation, self-efficacy, and cognitive engagement were lacking. In crisis situations, it should be remembered that the actions of the teacher and the school must take the form of a creative and flexible response to the specific crisis and it requires more reflection and communication than any of the previous learning experiences. For many people the pandemic was a transformation that required an understanding of how the lack of physical contact, decreased social interactions, and negative emotions (such as fear and a sense of insecurity) influenced the development of soft skills through crisis e-learning (Aguilera-Hermida, 2020).

The aim of the research was to show selected elements of crisis e-learning from the teachers' perspective. Investigating this topic is justified by the fact that the COVID-19 pandemic has had a very large impact on the functioning of societies, including educational activities and the organization of school life, as well as the digital competence and soft skills of teachers and students at various levels of education. It is extremely important given the fact that since the onset of the pandemic, education in Poland took place only remotely through the use of e-learning platforms; particularly in the first phase of emergency e-learning, teachers were forced to change their methods and forms of teaching from the traditional to the remote ones, while remembering to ensure the development of students' soft skills, mainly in the context of working together.

2. Theoretical framework and research overview

Technology defined how the system of education could be delivered during the COVID-19 pandemic (Toquero, 2021). The transition to the delivery of educational courses via the Internet, which is called Emergency Remote Teaching (Milligan, 2020; Hodges, Moore, Lockee, Trust, & Bond, 2020) or Emergency Remote Education (Green, Burrow, & Carvalho, 2020), caused distress and concern for teachers who had little or no previous experience with online teaching methods and techniques. All the teachers had to change their pedagogical strategies and introduce new tools as soon as possible. They also had to face the issues such as uncertainty about internet access. Both teachers and students had to deal with distance and isolation and the changes brought about by virtual learning (Green, Burrow, & Carvalho, 2020).

COVID-19 has made direct education difficult, however, the education sector needs to re-examine and recalibrate the application of technology that enables remote learning in emergencies with a greater focus on team-working and interpersonal relationships (Toquero, 2021). Computer supported collaborative learning (CSCL) presupposes the existence of technological systems constructed to support learning

according to a set of theories that sees knowledge as social and arrived at collaboratively, through interaction (Halavais, 2016; O'Malley, 2012). Computer Supported Collaborative Learning is based on the following main assumptions: (1) collaboration is the scaffold for learning; (2) learning is a complex adaptive system; (3) the relationship between teaching and learning is a dynamic process of knowledge exchange; (4) collaboration allows the identification of the student's own learning strategies; and (5) the online environment helps students achieve their learning goals (Chen, Wang, Kirschner, & Tsai, 2018).

Searching for the best model for the development of education that supports students in the process of learning and in their personal confrontation with new knowledge, the allosteric model of Andre Giordan (1998) was selected. The allosteric model assumes that first of all, the learning environment must create conditions for the learner and be full of meaningful situations. It should trigger the willingness to learn, and different contexts must stimulate, encourage, and challenge students. The role of the teacher is to filter information, and strengthen or reduce the effects of external stimuli. This approach can facilitate comparisons, connections (temporal, spatial, and causal), and encourage the organization of knowledge. First, it must create situations suitable for motivating and challenging students. The educational situation must constantly create a willingness to understand and to search for new solutions (Giordan, 1998). In Emergency Remote Education, teachers' competences and especially their level of digital literacy are the key factors (Cabero-Almenara, Guillén-Gámez, Ruiz-Palmero, & Palacios-Rodríguez, 2022; Tomczyk & Fedeli, 2022; Toto, Rossi, & Lombardi, 2022). Digital literacy is fast becoming a prerequisite for creativity, innovation, and entrepreneurship (Martin, 2006). Recent research moves beyond the prevailing technical conceptualizations, arguing for more holistic and broader-based understandings that recognize the increasingly complex knowledge and skills young people need to function ethically, safely, and productively in diverse, digitally mediated environments (Falloon, 2020). According to him the notion of competence implies a need for constant revision, reflecting changes to technological systems and uses that require some reflection on teacher training and current capabilities and needs, responding to rapidly changing educational environments and the opportunities that come with those environments.

The basic theoretical framework involves elements of Emergency Remote Education, Computer Supported Collaborative Learning, and Digital Literacy and the main assumptions of the allosteric model. The theoretical background of the research is presented in Table 1. and Fig. 1.

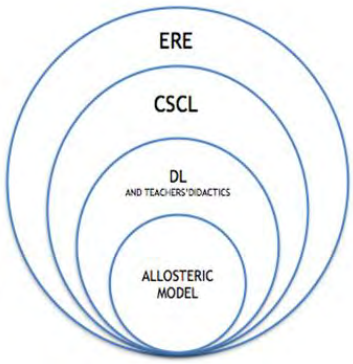

Fig. 1. Relationships between key research areas (ERE - Emergency remote education; CSCL - Computer supported collaborative learning; DL - Digital literacy)

Table 1
Theoretical background of the research

Theoretical backgrounds	Authors	Key words	Research Contexts
Emergency Remote Teaching/Education	Hodges et al., 2020; Green et al., 2020	activity, practice teacher, sharing knowledge and experience	Education via Internet during the pandemic (emergency e-learning)
Computer Supported Collaborative Learning	Halavais, 2016; O'Malley, 2012	feedback, collaboration, Complex Adaptive System, communication,	Levels of collaboration, teachers' social competence
Allosteric Model	Giordan, 1998	learning, educational environment, dimensions of learning: perceptual, emotional, cognitive, intracognitive, metacognitive, intentional	Role of the teacher, teaching methods in the time of the pandemic, organization of the process of teaching and learning
Digital Literacy	Martin, 2006; Falloon, 2020	competence, information processing paradigm shift in approaches to learning and teaching	Teachers' and students' skills

Digital literacy consists in using, understanding, accessing, managing, gathering, and evaluating information that comes from information and communication technology-based sources (Siero, 2017). Teachers' digital competencies become an important part of their teaching abilities following the challenges arising from their students' conditions (Rusydiyah, Purwati, & Prabowo, 2020) and are mentioned among the modern teacher's qualifications and competences, but cannot be considered more than a tool. Among contemporary theories of learning, Giordan's allosteric model has attracted attention because it seems to offer a possible solution to the problem of the role of the teacher in the virtual educational environment as it emphasizes the different dimensions of learning.

Pedagogical challenges are principally connected with teachers' and learners' lack of digital skills, the lack of structured content versus the abundance of online resources, and students' lack of interactivity and motivation, as well as teachers' lack of social and cognitive presence (Ferri, Grifoni, & Guzzo, 2020). At the same time, the pandemic may have accelerated some changes in educational models based on the benefits and drawbacks of the technology used for learning purposes. During the COVID-19 pandemic, distance learning solutions were introduced to maintain the link between schools and students, but the overall consequences of learning exclusively in the virtual environment are poorly understood (OCDE, 2020). The one-way model of crisis e-learning has been widely practiced, with the e-participatory model and m-teaching (mobile-teaching) being used slightly less frequently. Although all these models, may generally be classified as technological models, they require a revision of the presentation of their limitations and possibilities and their relationship with other models and pedagogical theories, including the allosteric model. According to Hattie (2020), however, care should be taken not to focus too much on the impact of school break-up on learning (Hattie, 2020). He recalls that the literature has shown only "minimal" effects of the length of the school year on student achievement because teachers then focused on "what needed to be learned" (Hattie, 2020). In this way most teaching processes are still dominated by teachers (Silalahi & Hutauruk, 2020). In order to ensure the effective operation of online learning, educators need to have some relevant experience, especially on the platforms and media used in online learning (Yusuf & Ahmad, 2020). For teaching

to be focused on the students, it is necessary to apply a cooperative learning model and the next challenge is to take that cooperative process online. The cooperative learning model works by giving opportunities to the students to build their knowledge together (Silalahi & Hutauruk, 2020). The sudden shift to online learning limited the opportunities for collaboration and knowledge sharing (Abcouwer, Takács, & Solymosy, 2021). There are many factors that influence the effectiveness of Emergency Remote Education, some of which are shown in Table 2.

Table 2
Study review connected with selected factors supporting the efficiency of ERE

Selected factors supporting ERE	Research examples
Collaboration and educational strategies	Sutarto et al. (2020), Abcouwer et al. (2021), Ozturk et al. (2021), Christian et al. (2020), Hattie (2020), Thomas & Rogers (2020), Silalahi & Hutauruk (2020)
Teachers' digital skills	Ferri et al. (2020), Yusuf & Ahmad (2020), Mukhtar et al. (2020), Verawardina et al. (2020), Demeshkant et al. (2022), Tomczyk (2020a, 2020b), Potyrała & Tomczyk (2021)
Internal and external environment	Outhwaite (2020), Garbe (2020), Hamilton et al. (2020)

Diagnosing and facilitating the development of digital literacy have become the key challenges which schools are facing today. The strategies used by teachers increase the students' interest in learning but at the same time there is a need to build the community of students and teachers and support the entire school community in this regard.

Therefore, the following research questions were explored:

RQ1: How do the teachers evaluate students' teamwork during crisis e-learning and is there a relationship between students' collaboration skills, the use of teaching methods, school's ICT infrastructure and teachers' digital competence?

RQ2: Are the teachers' attitudes to using ICT influenced by their age, gender, subject and the experience in using e-platforms?

3. Method

3.1. Research ethics

The authors defined ethics as a method, procedure and perspective for deciding how to act and analyse complex issues connected with the research. The psychological and sociological perspective and possible ethical values and principles were taken into account. The authors declare that the research complies with them.

The respondents took part in the survey voluntarily. The questionnaire, addressed to primary and secondary school teachers, did not contain any confidential data which would allow the identification of the respondents. The authors declare that there is no conflict of interest at any stage of conducting and analysing the research.

3.2. Research procedure

In formulating the research, the focus was put on analyzing the emergency e-learning during the COVID-19 pandemic. The decision was made to empirically explore the area of theoretical scientific research by drawing attention to student collaboration, school support, and the use of differentiated teaching methods by Polish teachers during the first wave of crisis e-learning in the period from March to May 2020. The present text is original and contributes to the discussion on the quality of current and future school education management in terms of online teaching-learning practice, especially in the area of student collaboration.

The research was carried out in an online form due to the epidemiological situation in Poland. It was performed using the Microsoft Forms website (from June to September 2020).

The respondents constituted a deliberately heterogeneous sample from all types of schools in the area of Malopolska Region in Poland. Nonprobability sampling was used due to the fact that the objective was to create a close representative sample and the respondents were selected on the basis of an arbitrary decision made by the researchers. Using the nonprobability sampling of selecting the research sample, data from 134 respondents were collected.

The data obtained as a result of the research were compiled and analyzed using descriptive statistics. The research analysis included predictive models (multivariate regression analysis), k-means cluster analysis, Standard Error of Regression Slope, and significance levels. Correlation was also sought between the collected research data.

The procedure of the study is outlined in Fig. 2.

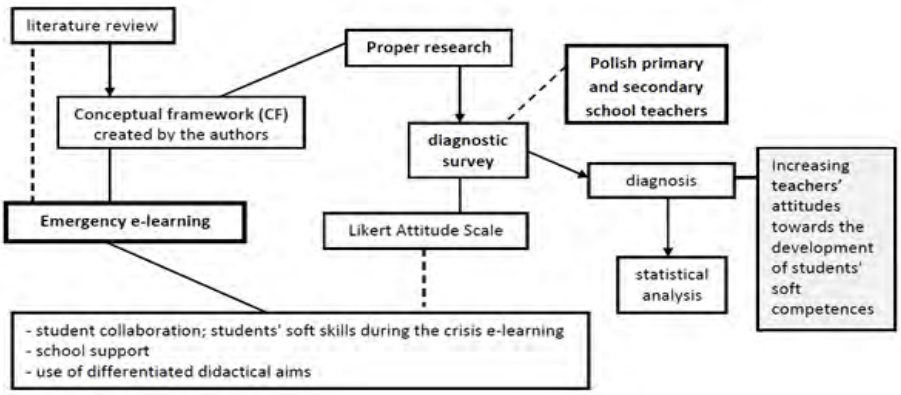

Fig. 2. Research procedure

The final version of this article was completed during the project Teachers of the future in the information society - between risk and opportunity paradigms PPN/BEK/2020/1/00176 (NAWA).

3.3. Research instrument

The research was conducted using a structured questionnaire containing statements developed on the Likert attitude scale (5 degrees) The tool is based on previous research

conducted by a team of experts from the Pedagogical University of Krakow (Demeshkant et al., 2022; Tomczyk, 2020b). The data were collected online.

The following variables were extracted in the research tool:

- The frequency of teachers' use of differentiated teaching methods (presentations, watching movies/listening to music, Video/Audio creation, e-learning platforms, digital quizzes and polls, interactive applications or games, digital posters, mind maps, planning tools, blog or Wiki). 8 indicators with answers were used on the Likert scale. The items evaluating this variable had a satisfactory internal consistency of Cronbach's = 0.867.
- Student collaboration and school support. The variable was assessed by 7 indicators related to: the development of students' collaboration with the use of ICT in individual classes, use of ICT for discussions, integration of ICT in the school environment, provision of necessary ICT resources for teachers and students, investment in ICT in school facilities, support in the operation of hardware and software provided by school management, assessment of the quality of Internet connections, support in the development of teachers' digital competence. Responses were placed on a 5-degree Likert scale ranging from 1 - low rating of a given area to 5 - high rating of a given area. The internal consistency for this variable was Cronbach's = 0.814.
- Sociodemographic metrics indicating gender, age, teaching experience, teaching course, kind of school/educational institution, scientific degree, and experience in using digital technologies.

3.4. Research sample

The research was conducted on a sample of 134 teachers from different types of schools in Poland during the first period of crisis e-learning (March - May 2020). The research covered primary and secondary school teachers. The participants constituted a deliberately heterogeneous sample representing every type of school in Malopolska Region.

The study sample was outlined in Table 3.

Table 3
Research sample

Variables	*N*	%
Gender		
Female	112	83.5%
Male	12	9.0%
Prefer not to give	10	7.5%
Age		
25-30 years	12	9.0%
31-35 years	12	9.0%
36-40 years	15	11.2%
41-50 years	50	37.3%
51-60 years	42	31.3%
Over 60 years	3	2.2%

Teaching experience		
0-5 years	14	10.4%
6-10 years	13	9.7%
11-15 years	16	11.9%
16-20 years	18	13.4%
21-25 years	24	17.9%
26-30 years	26	19.4%
31-35 years	17	12.7%
36-40 years	6	4.5%
Teaching course*		
humanities	61	*Respondents could choose more than one answer
science courses	40	
environmental courses	30	
elementary education courses	72	
physical education	55	
arts courses	66	
religion courses	21	
humanities	61	
Kind of school/educational institution		
primary school	88	65.7%
secondary school	20	14.9%
other (nursery school, boarding school, cultural centres)	24	17.9%
higher school	2	1.5%
Scientific degree		
PhD	2	1.5%
M.Sc. & MA	132	98.5%
Experience in using digital technologies in teaching		
0-5 years	34	25.4%
6-10 years	60	44.8%
11-15 years	18	13.4%
16-20 years	22	16.4%

The deliberate selection of study participants was performed by searching the websites of schools in Malopolska Region using snowball sampling. The method of non-random sampling consisting in recruiting participants through other participants (Castillo, 2009). Respondents received a link with the questionnaire via e-mail.

4. Results

Based on the collected data, it was noted that only 40% of the teachers indicated that their students worked with each other during e-learning activities. Almost a third of the teachers indicated that their students operate in the virtual environment without working or communicating with each other. Moreover, one in five teachers emphasized the fact that the specificity of the subject they teach in cyberspace does not allow for the development of collaboration skills. The detailed analysis answers of this topic is presented in Fig. 3.

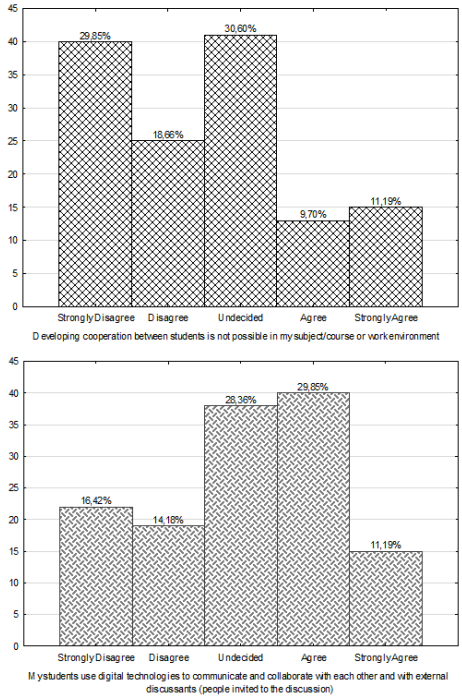

Fig. 3. Collaboration in crisis e-learning (in %)

Teacher's gender is not correlated with the perception of contingency e-learning in terms of developing collaboration between students through ICT. However, among male teachers, opinions are slightly more varied than among females. This relationship is shown in Fig. 4.

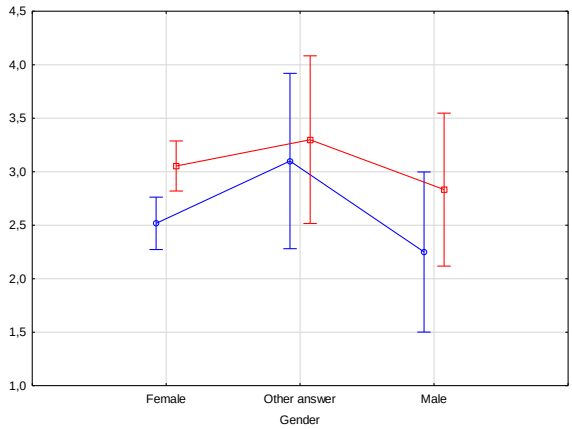

Fig. 4. Teacher gender and perceptions of student collaboration using ICT

In crisis e-learning the preparation of teachers for the use of ICT (digital competence) and the institutional factor are of great importance. The latter was analyzed in this study. The teachers surveyed were asked about the promotion of the idea of ICT integration in the teaching process, investment in equipment and teaching resources based

on ICT, the provision of technical support in terms of operation and maintaining the stability of Internet connections, as well as supporting the development of the digital competence of teachers. These are the elements of utmost importance especially in the first phase of crisis e-learning. In most of the categories listed above, the teachers perceive a positive dimension to the actions taken at school. For example, more than seventy-three percent of the respondents indicate that activities related to the integration of ICT into educational activities are promoted at school. More than two-thirds of the teachers indicate that technical IT facilities are being upgraded. Half of the teachers declare that the school provides the necessary resources for using ICT in education. On the other hand, less than half declare that the Internet at school is stable and fast. A similar percentage indicate that the school authorities have sought to strengthen the digital competence of teachers (e.g., through training). The detailed analysis of the answers is presented in Table 4.

Table 4
Teachers' perception of school support in crisis e-learning (in%)

	The school promotes the integration of digital technology and teaching	The school invests in upgrading and updating its technical infrastructure	The school provides the necessary technical support on digital technologies	The school's internet connection is fast and reliable	The school supports the development of my digital competence, e.g., through continuing professional development activities
Strongly Disagree	1.5	5.2	10.4	9.7	6.7
Disagree	3.7	14.2	15.7	17.9	13.4
Undecided	21.6	14.9	23.9	16.4	23.9
Agree	47.0	43.3	36.6	40.3	40.3
Strongly Agree	26.1	22.4	13.4	15.7	15.7

In the analysis of the teachers' statements, it was noted that males rated each element of support from the school slightly higher. However, these relationships are not statistically significant. The details are presented in Fig. 5.

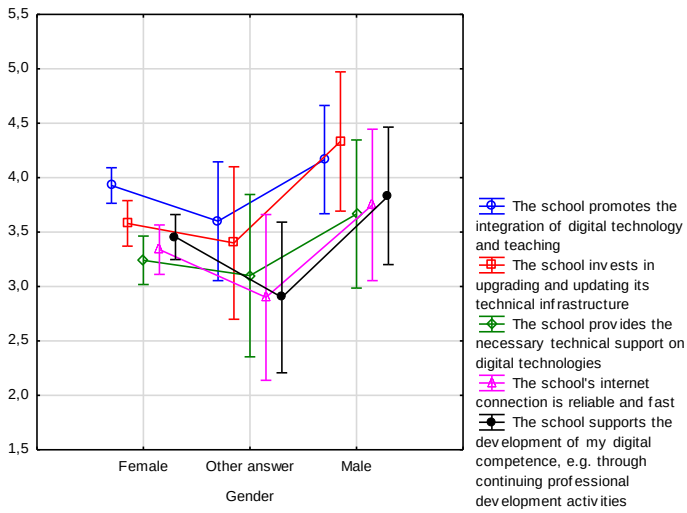

Fig. 5. Gender and perception of school support in crisis e-learning

Crisis e-learning is characterized by myriad challenges. One of these is the diversity of forms and teaching methods used during classes delivered in cyberspace. On the basis of the collected data, it was noted that the respondents most frequently used the following: films, presentations, e-learning platforms, and interactive applications and games. The least frequently used in the educational process were blogs and websites based on Wiki technology, as well as activities related to user creation of audio and video files. Less than 4% of teachers did not use multimedia presentations during crisis e-learning. The detailed information on the use of different teaching methods is presented in Table 5.

Table 5
Teaching methods used in crisis e-learning (in %)

	Presentations	Watching movies/ listening to music	Video/ Audio creation	e-Learning platforms	Digital quizzes and polls	Interactive applications or games	Digital posters, mind maps, planning tools	Blog or Wiki
Never	3.7	1.5	44.0	17.2	19.4	18.7	26.9	56.0
Rarely	39.6	26.9	36.6	34.3	38.1	32.1	39.6	29.1
Often	44.8	51.5	13.4	32.8	29.9	35.1	24.6	10.5
Always	11.9	20.2	6.0	15.7	12.7	14.2	9.0	4.5
Mean	2.6	2.9	1.8	2.5	2.4	2.4	2.2	1.6
Std. Dev.	0.7	0.7	0.9	1.0	0.9	1.0	0.9	0.8

Considering the data collected, it has been noted from the correlation analysis that the selected areas of support for digital maturity in the school environment are interrelated. For example, there is a strong correlation between investment in new equipment and the school securing equipment during the COVID-19 pandemic. Other areas, such as those concerning the development of digital competence, are in a noticeable relationship with modernization and maintaining the quality of ICT equipment at school. A relationship has also been noticed between the declarations about the lack of use of differentiated digital means and the opinion about the possibility of using ICT in developing collaboration between students in specific subjects. This means that teachers who have rarely used differentiated digital teaching resources also often perceive ICT as a tool that cannot be used to develop collaborative skills among students.

Furthermore, it has been perceived that the use of selected teaching resources stands in a mutual relationship. Teachers who have often used a few digital teaching methods often reach for other digital solutions. Examples include the use of digital games and digital quizzes. The activity of using one solution to reinforce engagement and the diversity of working methods is linked to other areas. It has also been noted that age and seniority are not in a strong relationship with the use of differentiated ICT techniques, or the perception of the school as an institution striving to achieve a high level of digital maturity. The details of the relationships between the variables are presented in Table 6 (see Appendix I).

The use of predictive models (multivariate regression analysis) has allowed us to observe that the perception of ICT as a means of triggering collaboration between students is related to the intensity of the teachers' use of e-learning platforms and the teachers' age. It has been observed that for the adopted model it is true ($R^2 = 0.269$; $F(15,118) = 2.89$; $p < 0.000$) that as the intensity of use of e-learning platforms increases,

the level of feeling that ICT can positively trigger collaboration between students increases. In contrast, the older the teachers, the more skeptical they are about the potential of ICT to trigger collaboration among students. Other factors have had no significant statistical effect. The details are shown in Table 7.

Table 7
Multivariate regression analysis - Predictive model for the development of student collaboration in crisis e-learning

	β	*Std. err β*	*b*	*Std. err b*	*t(118)*	*p*
Intercept			4.130	1.121	3.685	.000
The school promotes the integration of digital technology and teaching	-.027	.107	-.038	.153	-.250	.803
The school invests in upgrading and updating its technical infrastructure	.040	.157	.044	.173	.254	.800
The school provides the necessary technical support on digital technologies	.003	.154	.003	.162	.020	.984
The school's internet connection is fast and reliable	.189	.107	.193	.110	1.762	.081
The school supports the development of my digital competence, e.g., through continuing professional development activities	-.072	.124	-.081	.138	-.583	.561
Presentations	.024	.099	.041	.167	.247	.805
Watching movies/listening to music	-.101	.088	-.173	.151	-1.148	.253
Video/Audio creation	-.176	.095	-.247	.134	-1.841	.068
e-Learning platforms	.203	.100	.264	.130	2.026	.045
Digital quizzes and polls	.111	.111	.147	.147	.999	.320
Interactive applications or games	-.038	.104	-.050	.136	-.367	.715
Digital posters, mind maps, planning tools	.179	.110	.242	.149	1.624	.107
Blog or Wiki	.148	.105	.219	.154	1.418	.159
Age	-.627	.238	-.083	.032	-2.638	.009

Using k-means cluster analysis, it was noted that three groups could be distinguished in the sample. The first group is characterized by an average level of support from the school, as well as the low level of use of the possibilities of digital teaching resources. This is the group (35.07%) that, despite receiving various forms of support in the school setting, is not interested in diversifying the use of teaching methods in crisis e-learning. The second group (35.82%) is made up of teachers who receive almost every kind of support from the management of the educational institution, while at the same time these teachers do make use of the opportunities provided by the selected digital teaching resources. There is also a group of teachers (29.11%) who, despite the fact that they did not receive due support from the school in terms of computerization, still tried to use the teaching potential present in cyberspace.

The results of the cluster analysis are presented in Fig. 6.

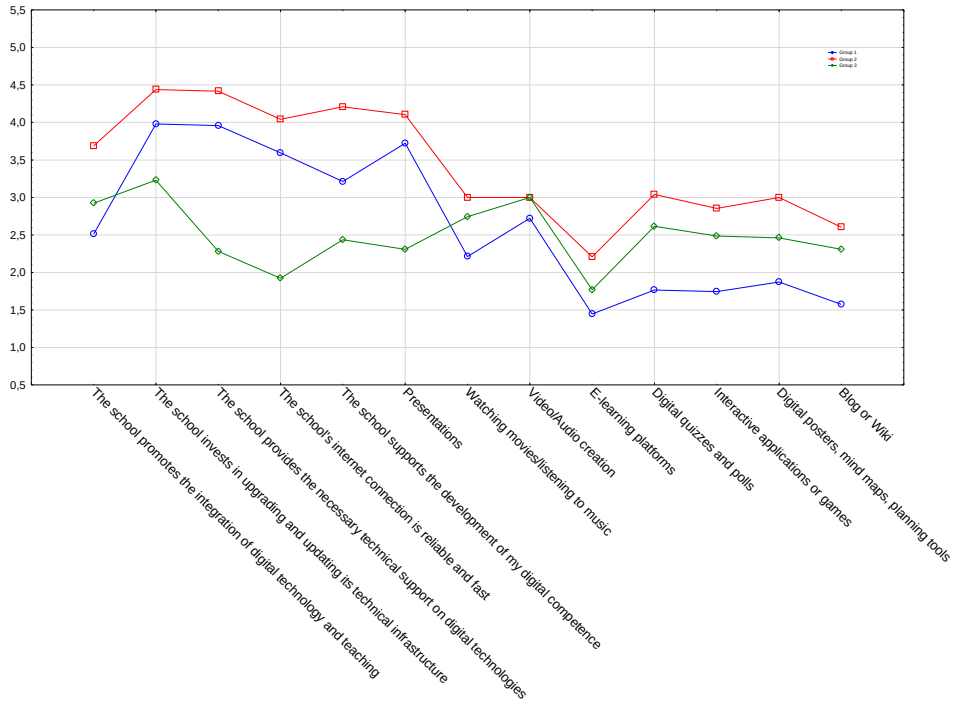

Fig. 6. Cluster analysis - School support and use of differentiated teaching methods during crisis e-learning

5. Discussion

The obtained results highlight the significance of and interrelationship between school students and teachers during crisis remote education. Research into the creative use of specific technologies to improve communication between students and schools would also benefit from online and distance education (Clausen, Bunte, & Robertson, 2020).

Communication strategies between teachers, students and families are key components for learning, especially in formalized and remote formats (Akcaoglu & Lee, 2018). These strategies can lead to essential interactions that build classroom communities online and enhance learning outcomes. Interactions among learners and instructors can motivate students to learn and can influence the effectiveness of the learning process (Clausen, Bunte, & Robertson, 2020). Peer engagement is fundamental to student engagement, and it creates a support network that facilitates student learning. However, it has not provided a replacement for personal interactions (Ewing & Cooper, 2021; Stanojević, Cenić, & Cenić, 2018).

Our study results show that almost the third of school students have not developed the ability to work together during emergency e-learning and about the fifth of teachers suggest that their subject, delivered online, does not enable the use of methods to activate peer engagement among their students. These results are in line with some recent studies according to which teachers were unsuccessful in making contact with majority of their

students during the pandemic online learning (Clausen, Bunte, & Robertson, 2020; Oladele, Opele, Avwioro, Afolabi, & Awotorebo, 2022; Weldon, Ma, Ho, & Li, 2021). This means that teachers need to improve their professional competence, especially regarding remote teaching. To keep up with the new trends in distance learning education, teachers should be equipped with the knowledge and skills they need for distance education (Rhini, 2018).

According to Phan and Dang (2017), factors such as training, attitude, technical competence, time constraints, pedagogy, and methodology are the major distance learning education elements (Phan & Dang, 2017). The conclusions of the research conducted by Kruszewska et al. (2022) among Polish teachers confirm that teachers were not prepared to work using the new educational platforms, and there was a strong need for training in this area (Kruszewska et al., 2022). Similar conclusions have been proposed by Fiş Erümit (2020), who highlights the importance of developing teachers' technological-pedagogical content knowledge and appropriate teaching methods and techniques, especially in televisual distance education as this is based on one-way communication and lacks interaction (Fiş Erümit, 2020). Similar results were recorded by Sokal et al. (2020), who found that teachers face significant challenges in adapting to online teaching, maintaining adequate communication with students, and supporting students' learning and development (Sokal et al., 2020).

Regarding emergency remote teaching, the primary objective was not to re-create a regular educational ecosystem, but rather to provide temporary access to instruction in a manner that was quick to set up and that would be reliably available during the emergency or crisis (Hodges & Fowler, 2020).

Our next group of study results concern the school as an element supporting teachers in crisis e-learning. The significant majority of respondents underlined the fact that their schools actively promote the idea of the implementation of ICT in the school's teaching, with principles systematically modernizing the available ICT facilities. Around half of the surveyed teachers were supported by their school authorities in strengthening their digital competence. Similar results were found by Alea et al. (2020) who reported that about half of the schools studied were equipped with the facilities and training in distance education during difficult times and provided technical support to their teachers (Alea et al., 2020). School districts have sought help from private businesses and organizations to improve access to school materials, and to provide devices and wireless internet access to those in need (Ali & Herrera, 2020).

The COVID-19 pandemic has expedited the adoption of technology in schools. In this study we demonstrated the significant role of the school in supporting teachers in crisis e-learning. Since for epidemiological reasons the education system must avoid face to face interaction, the school and other educational institutions will continue to play a vital role in this continued journey of transition, since they are the ones who provide training and workshops that equip teachers with the necessary skills and knowledge for distance education (Alea et al., 2020; Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2020). However, our results show that technical support for remote education is still relatively poor in the majority of Polish schools (indeed, in half of those studied). At the same time it was noticed that those schools which invest in technical facilitation support the development of digital competence among teachers.

Our study results showed that the most popular teaching methods used during remote e-learning are videos, presentations, e-learning platforms, and games and applications. These results are partly similar to Dhawan (2020), who claimed that educators can use a combination of audio, videos, and text to reach out to their students in

this time of crisis to add a human touch to their lectures (Dhawan, 2020). Online learning methods utilize various internet-based applications to distribute classroom materials and help learners and educators interact with one another (Jena, 2020). According to Clark and Mayer (2016) some virtual classroom formats that can be employed for integral education are videos, forums, video calls, photos, etc. These technologies are characterized by their capacity to save and transmit lessons in an electronic format (Clark & Mayer, 2016). Gewin (2020) highlights that these tools guide and support students as they move towards their desired goals, enabling creativity in both directions (Gewin, 2020). We agree with the statement that during the pandemic, teachers had a tendency to use technologies to reproduce traditional transmissive teaching dynamics, which is a reductionist approach to Technology Enhanced Learning (Giovannella, Marcello, & Donatella, 2020; Meier, 2012).

Regarding the correlation between teachers' differentiation of digital teaching methods and their belief in the opportunities to develop students' soft skills, our findings correspond with König et al. (2020) who argue that teachers' digital competence was significant in predicting the maintenance of social contact and the provision of task differentiation. This means that teachers who performed better in the test also reported having maintained communication and delivered online adaptive teaching more frequently during the period of school lockdown (König et al., 2020). Accordingly, teachers who already had software resources at their disposal and were familiar with their use in teaching were clearly advantaged when the school lockdown began.

Our results did not demonstrate a correlation between the demographic profiles of the respondents and the studied variables. A teacher's age was the only significant variable that increased teachers' positive attitude towards using the potential of ICT to trigger collaboration among students. These results are in contrast to König et al., who reported that early career teachers' status does not guarantee that they have developed sophisticated digital skills in general (König et al., 2020). However, some studies claim that in terms of the correlation between teachers' demographic profiles and readiness for distance education, the length of teaching experience is found to be very strongly correlated (Alea et al., 2020).

6. Research limitations and new directions for research

The findings of this study have to be viewed, however, in the light of some limitations. Since this is a subjective study where teachers' statements provided the data, the researchers cannot entirely rule out limitations in the collection and analysis of subjective data measuring the perspectives of teachers regarding selected elements of crisis e-learning. Another limitation of this study is the selection bias of the study participants due to the limited access to the geographical region. The survey was conducted with purposely heterogeneous samples of teachers in the schools of Malopolska Region, thereby constituting a sample bias since these respondents may not truly be a good representation of schools across the country. Furthermore, the snowballing sampling procedure used in this research may have given the researchers little control over the sampling method and the representativeness of this study sample may not be guaranteed.

To address this limitation, future studies should consider the use of snowballing sampling of teachers with a qualitative research approach to form a mixed method study, as doing so will ensure that there is confirmation of the teacher's perspective about the research subjects, thereby minimizing the sample bias. This study also faces the lack of sufficient samples for quantitative statistical measurement. A sample of 134 teachers

from different types of schools in Poland may not be sufficient to represent the entire population, thereby making it difficult to identify significant relationships within the data, for example when evaluating teachers' concerns about developing students' soft skills during the period of crisis e-learning. A larger sample size could make this study more generalizable and valid for studying the teacher's perspectives on selected elements of emergency e-learning.

For future research, it will be fundamental to create a learning model for emergency e-learning grounded on sound theoretical and pedagogical principles. The emergency e-learning model must consider the interrelationship and collaboration between learners, the teachers, and the context of learning. Looking further ahead, crisis e-learning will safeguard the educational system, the learning infrastructure, and differentiated learning expectations of students in potential future pandemics. Furthermore, such a crisis e-learning model should be able to answer pragmatic questions about ways in which the educational environment could switch seamlessly to crisis e-learning mode and if teachers' needs are completely catered for in the preparations for emergency e-learning.

7. Conclusions

In summary, this study argued that there are important connections between school students and teachers that must be maintained during emergency e-learning. The outcome of this study proved the fact that about a third of school students were not able to develop their ability to collaborate during emergency e-learning because of the teachers' attitude to ICT use as well as their poor competence. One fifth of the teachers surveyed suggested that their online courses did not support the activation of student-student engagement.

This study identified that the Polish school authorities have provided significant support for teachers' ICT needs such as the implementation of ICT in the teaching methods of the school, the strengthening of teacher's digital competence, the modernization of the ICT infrastructure, and providing incentives to support the teacher's use of ICT. The ICT intervention is timely as it will enable the teachers to feel confident in their work, and will motivate a strong working environment in this ongoing pandemic e-learning situation. Furthermore, this study shows that there are no new teaching methods adopted by the teachers during remote e-learning as familiar methods such as videos, presentations, e-learning platforms, and games and applications were predominantly used by the teachers. It is expected that future studies will investigate new pedagogical approaches and techniques that may facilitate a learning model for emergency e-learning. For example, new pedagogical techniques that will facilitate student-student collaboration and participatory learning in an emergency e-learning scenario should be researched further.

Author Statement

The authors declare that there is no conflict of interest.

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Appendix I

Table 6
Correlations between variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. ICT impossible to use in the context of developing collaboration between pupils	-															
2. ICT communicate between students	-.340**	- —														
3. School promote ICT integration	-.177*	.111	- —													
4. School invest and upgrade ICT	-.079	.082	.564***	- —												
5. School provide ICT	-.096	.090	.481***	.804***	- —											
6. School provide fast Internet connection	-.212*	.199*	.511***	.469***	.513***	- —										
7. Develop digital literacy	-.080	-.002	.451***	.661***	.646***	.503***	- —									
8. Presentations	-.422***	.252**	.072	.040	.067	.196*	.073	- —								
9. Watching movies listening music	-.145	.011	.050	.021	.064	.068	.067	.123	- —							
10. Video audio creation	-.134	.057	.194*	.138	.162	.124	.180*	.281**	.267**	- —						
11. e-Learning platforms	-.415***	.322***	.240**	.120	.091	.139	.054	.457***	.138	.325***	- —					
12. Digital quizzes and polls	-.457***	.315***	.167	.040	-.030	.243**	.047	.471***	.190*	.217*	.446***	- —				
13. Interactive applications or game	-.437***	.201*	.225**	.121	.101	.187*	.092	.299***	.314***	.337***	.443***	.543***	- —			
14. Digital posters	-.250**	.348***	.189*	.100	.110	.218*	.037	.405***	.299***	.417***	.410***	.465***	.441***	- —		
15. Blog or Wiki	-.275**	.282***	.231**	.119	.169	.189*	-.063	.154	.213*	.307***	.286***	.324***	.302***	.539***	- —	
16. Age	.153	-.142	-.022	.073	-.071	.093	.037	-.079	.119	-.167	-.137	-.126	-.179*	-.208*	-.162	-
17. Teaching experience	.174*	-.086	-.065	.053	-.075	.054	.023	-.053	-.096	-.134	-.149	-.114	-.151	-.190*	-.165	.937