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Web 2.0 Technologies in Times of Pandemic COVID-19:
Pedagogical Experience

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ABSTRACT

This study substantiates the feasibility of implementing Web 2.0 services in practical educational activities and classifies the main types of Web 2.0 services adaptive to educational goals. A survey of 58 teachers from the First Moscow State Medical University, Kuban State Technological University, the Herzen State Pedagogical University of Russia, and Yelabuga Institute of Kazan (Volga Region) Federal University was conducted; their pedagogical experiences interacting with Web 2.0 services were considered in order to provide effective technological support for educational interactions in the context of distance learning in the era of COVID-19. The survey results showed that the most popular Web 2.0 services teachers use in distance learning include social networking services and virtual meeting and conference services. The study confirmed that using Web 2.0 services in educational processes can ensure high-quality digital pedagogy.

KEYWORDS

COVID-19 Pandemic, Digital Pedagogy, Digital Technologies, Online Learning, Web 2.0 Services

INTRODUCTION

The COVID-19 pandemic led to a massive global public health campaign to implement mitigation strategies to prevent the spread of the virus by encouraging changes in social behavior, including avoiding crowds and physical distancing (Phadnis et al., 2021). While attempting to introduce these changes to maintain the status quo, various human activities (e.g., shopping, learning, work, meetings, and entertainment) have been moved from offline to online. This shift led to the accelerated spread of new digital technologies (Vargo et al., 2020) and initiated a large-scale digital transformation in society (Iivari et al., 2020). As the workplace has become digital, people's participation in digital technologies and their application of new knowledge gained from the digital environment has

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become a driving force behind business activities. Digital competencies are now the mainstay of any organizational strategy. A hybrid conceptualization of a digitally literate professional able to understand instrumental knowledge and communicate and collaborate (via social media) is the key request in the modern labor market (Nachmias et al., 2021).

The COVID-19 pandemic demanded a rapid transition to online studying (Ala et al., 2023). After the outbreak of the COVID-19 pandemic, universities around the world took every possible measure to ensure the continuity of student learning and well-being. The quarantine and campus closings seriously affected educational systems and teaching and learning processes. In particular, during the COVID-19 pandemic, the use of various online learning platforms, media, mobile applications, and social networking sites increased to enable virtual learning collaboration (Alsoud & Harasis, 2021).

The active trend towards the proliferation of social media tools has had a global impact on social interactions. Social media have demonstrated the potential to become essential disruptive technologies for building cutting-edge educational models (Mbabazi et al., 2020). Social media has become a key applied learning tool due to the development of online tools and technologies. Social media technologies allow educators to engage students in learning while investing valuable time in assignments and self-directed learning. Generally, assignments delivered with the help of online communication services allow users to connect and communicate with others regardless of time and geographic barriers (Purvis et al., 2020). In addition, social media can be used as an alternative to learning resources and other learning platforms, which tend to require paid subscriptions (Thaariq, 2020).

The functionality of network communication services is steadily expanding beyond calls and messaging. One of the ways online communication services compete is by developing new features or targeting a specific user group (Ofcom, 2020). The proliferation of mobile media has made anytime-anywhere learning more popular with the younger generation. The COVID-19 pandemic has increased addiction to online learning, which uses the Internet as a medium and transmission channel and smart mobile devices as an interface for human interaction with the digital world (Xu, 2021). Online educational models offer a comprehensive, consistent, and integrated set of e-learning tools that can connect unrelated learners to institutional resources. Thus, eLearning tools ensure virtual and portable learning environments regardless of the learner's location. Classrooms have moved beyond physical boundaries into online forums, and the level of abstraction has penetrated the current teaching and learning environment. That is, the learning environment is divided into local (or physical) space and global (or online) space (Mathrani et al., 2021).

Today, the Internet has a wide range of educational portals, sites, blogs, and communities that provide access to various electronic educational resources. E-learning based on remote technologies relies on the network interaction of participants in the educational process. In addition, the use of social networking services in the educational process is gaining popularity; these can serve as web designers to create educational materials, a social learning environment, and a tool for implementing practical communication interactions in the process of performing individual work and other educational activities (Gerasimova, 2021). Modern research suggests that the use of Web 2.0 services in educational institutions can contribute to the development of pedagogical innovation as they allow the creation of new forms of collective creativity, content sharing, and communication between students and teachers (Bassani & Barbosa, 2018).

Educational interaction through social media is the optimal solution in the COVID-19 era. The availability and widespread use of social media platforms among students and teachers means that user training or a technological readiness assessment is not required. However, it should be noted that teachers' and students' sustainable use of social networks in education requires optimal monitoring, motivation, and planning of online pedagogical activities (Cavus et al., 2021). Although blended learning can offer students more flexibility and accessibility, its planning greatly affects the quality and acceptance of this learning model. Unlike theoretical courses, studio courses require more focus on the course design and the appropriate ratio of online and face-to-face classes. Innovative technological

solutions that, in particular, increase interactivity are expected to improve students' virtual learning experience (Bamoallem & Altarteer, 2022).

In the context of online learning, teachers at higher educational institutions must find, implement, and adapt modern technological solutions that contribute to high-quality digital pedagogy. This research explores how teachers utilize established Web 2.0 mechanisms and technologies and the additional possibilities that emerged due to the pandemic. The research aims to study the pedagogical experience of using Web 2.0 services in education during the pandemic. To achieve this goal, we set the following tasks:

- to theoretically substantiate the feasibility of implementing Web 2.0 services in practical educational activities in the context of the pandemic and its associated social restrictions;
- to classify the main types of Web 2.0 services adaptive to educational goals;
- to conduct a survey of teachers from First Moscow State Medical University, Kuban State Technological University, the Herzen State Pedagogical University of Russia, and Yelabuga Institute of Kazan (Volga Region) Federal University and consider their pedagogical experiences of interacting with Web 2.0 services to provide effective technological support for educational interactions in the context of distance learning in the COVID-19 era; and
- to develop a model of an effective educational process in the context of the COVID-19 pandemic.

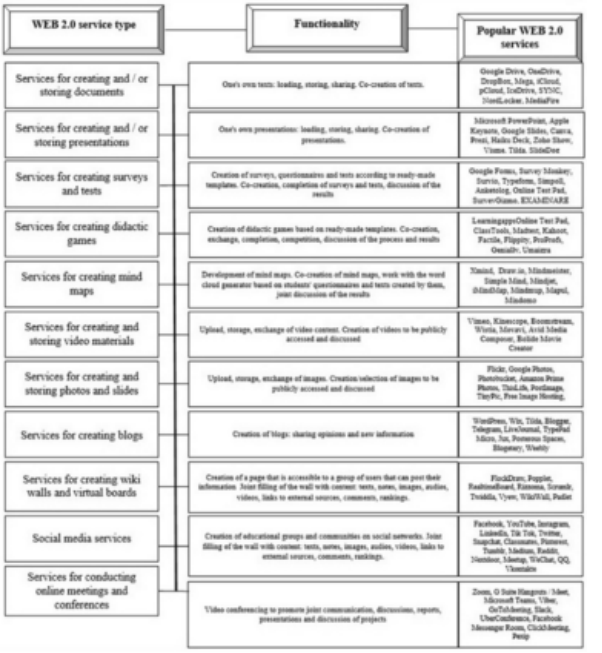
LITERATURE REVIEW

The rapid pace of technological development has had a significant impact on education (Zakota, 2020). In the modern information society, where the value of information and information technology has increased, the digital divide has gradually acquired a new definition and become a qualitative indicator of the use of devices and the transmission of information flows (Akhitova, 2023). Access to devices used to be an indicator of nations' digital literacy; now, it has become an indicator of support for information flows and communication processes. Illustrating this shift, the penetration of mobile communication devices and Internet access today has reached the point where every second person owns a smart device and has access to online services (Molnár et al., 2019).

The emergence and development of the Internet in the 1990s gave impetus to breakthroughs in education. Web 1.0 was the first generation of the Internet; its main focus involved the creation, accessibility, and commercialization of the Internet. Since Web 1.0 was designed and developed using a restrictive one-way communication platform, users could only view, read, and retrieve information. In 2005, O'Reilly developed second-generation Web 2.0, providing users with a much more transformative platform for reading, writing, and implementing social interactions (Ohei & Brink, 2019). Web 2.0 is an up-to-date concept of Internet development based on social services (blogs, communities, chats and forums, remote collaboration with open content), whose main feature is to organize the interaction of service users in the form of a public exchange of information resources, joint assessment, and labeling of content (Shugaeva et al., 2020). Today, the Internet is filled with various social networking services (online services based on Web 2.0) and web applications that can be used for various purposes, such as storing and editing data, communicating, and making presentations (Gerasimova, 2021). Active user interaction is implemented through various Web 2.0 services, such as blogs, microblogging, social networks (Facebook), social bookmarking, wikis, and file sharing (Bassani & Barbosa, 2018). Currently, many Web 2.0 tools can be used to ensure personalized and group communication, cooperation, and interaction of participants in the educational process, as well as to foster students' creativity in an interactive educational environment (Karakaş & Kartal, 2020).

Web 2.0 technologies offer educators new teaching and learning tools that revolutionize how teachers and students interact within and outside the classroom. The effective use of these tools improves the quality of student-centered learning and promotes lifelong learning (Mbabazi et al., 2020). The main types of Web 2.0 services are shown in Figure 1.

Figure 1. The main types of web 2.0 services adaptive to educational goals (Source: Own development based on Shugaeva et al. (2020))



Web 2.0 technologies have merged into many students' everyday and academic lives. Web 2.0 is so attractive in education because it helps students read, write, think, and reflect during their learning activities. The main factor differentiating Web 2.0 technologies from other web technologies is that users become active participants in content creation in the learning process. Thus, users can collaborate and interact with each other, contribute to learning content based on their needs, and share their thoughts at any time (Sonmez & Cakir, 2021).

Web 2.0 technologies allow users to interact in real time and actively participate in the topic under discussion (Chisag et al., 2020). Social media platforms have evolved from simple communication tools to interactive resource-sharing tools based on the principles of "using collective intelligence" and "trusting users as co-developers" (Williams, 2020, p. 139). Web 2.0 tools encourage students to post, share, and comment on educational materials and enable them to access the educational resources they need independently. Web 2.0 applications and services facilitate collaboration and promote the creation and dissemination of knowledge (Doung-In, 2018).

In addition, Web 2.0 technologies can personalize the learning process by allowing users to create their own texts, videos, and audio tracks, encouraging students' creativity. Mobile applications and interactive Web 2.0 tools offer the following features: accessibility (the ability to work remotely regardless of location), openness (the ability to express one's opinion and comment), interactivity (the ability to receive comments on one's publications in real time or asynchronously) and teamwork (collaboration, team responsibility, team spirit). Using such features optimizes the learning process while steadily improving the effectiveness of educational interactions (Kazhan et al., 2020).

Online communication platforms have become a popular tool to ensure educational interactions at universities. Using blogs to create fast, responsive content and commentary is an effective alternative to the slow process of other types of academic publishing. In addition, several networks for collaboration, knowledge sharing, and knowledge development are driven by social media. Social media platforms have become practical tools for creating transnational academic communities (Rospigliosi, 2019).

MATERIALS AND METHODS

Research Design and Sample

In May 2021, we conducted a study to understand teachers' pedagogical experiences interacting with WEB 2.0 services in the context of distance learning in the COVID-19 era. We also identified the possibilities of using WEB 2.0 services to promote educational interaction effectively. The study involved 58 teachers from First Moscow State Medical University, Kuban State Technological University, the Herzen State Pedagogical University of Russia, and Yelabuga Institute of Kazan (Volga Region) Federal University (Table 1).

Table 1. Research participants

Number of participants	Departments	University
3	Department of Life Safety and Disaster Medicine	Sechenov First Moscow State Medical University
1	Department of Information and Internet Technologies	
2	Department of Medical Informatics and Statistics	
3	Department of General Medicine	
3	Department of Public Health and Healthcare named after N.A. Semashko	
3	Department of Pedagogy and Medical Psychology	
1	Department of Sports Medicine and Medical Rehabilitation	
3	Department of Transport Facilities named after Professor K.A. Daragan	Kuban State Technological University
2	Department of National Inventory and Geoengineering	
3	Department of Architecture of Civil and Industrial Buildings and Constructions	
1	Department of Civil Construction	
3	Department of Technology, Construction Economics and Real Estate Management	
2	Department of Descriptive Geometry, Engineering and Computer Graphics	
3	Department of the Russian Language	
2	Department of Foreign Languages No. 1	
1	Department of Foreign Languages No. 2	
2	Department of History, Philosophy and Psychology	
2	Department of Chemical and Environmental education	The Herzen State Pedagogical University of Russia
6	Department of Psychology	Yelabuga Institute of Kazan (Volga Region) Federal University
5	Department of Mathematics and Applied Informatics	
5	Department of Pedagogy	
2	Department of Economics and Management	
Total: 58 people		

The research participants were invited to complete two online questionnaires compiled in Google Forms (Tables 2 and 3).

Instruments

We examined the reliability of the instruments by measuring internal consistency using the Cronbach's alpha method. To reduce the results to a parametric form, a positive response was coded as "1" and a negative response as "0." The result for the questionnaire (stage 1) was $\alpha = 0.781$; for the questionnaire (stage 2) $\alpha = 0.752$. Thus, the reliability tests indicate that the questionnaires can be applied with confidence.

We verified the validity of the tests using a survey of experts. We invited 11 pedagogical experts who have peer-reviewed publications outside their countries, have been working in higher education pedagogy for at least five years, have used online learning and distance learning forms for at least three years, and are familiar with the described technologies in pedagogy. We asked them to assess the compliance of each study area test using a 5-point Likert scale, ranging from 5 for "completely" to 1 for "almost not at all." The questionnaire (stage 1) obtained an average score of 4.11 points, and the questionnaire (stage 2) obtained an average score of 4.56. Thus, the primary confirmation of the validity of the questionnaires can be considered sufficient for the study.

Ethical Issues

Before the survey, the research participants were informed about the purpose and objectives of the study and provided written consent to participate in the experiment and publish the results.

Research Limitations

The research focused on the pedagogical experience of using Web 2.0 services in education during the pandemic. It aimed to reveal prospects for online education modernization while limiting

Table 2. Questionnaire for research participants (Stage 1)

In the context of the transition to distance learning associated with the pandemic, have you used WEB 2.0 services in teaching?		
	Answer option (✓)	
	Yes	**No**
Services for creating and/or storing documents		
Services for creating and/or storing presentations		
Services for creating surveys and tests		
Services for creating didactic games		
Services for creating mind maps		
Services for creating and storing video materials		
Services for creating and storing photos and slides		
Services for creating blogs		
Services for creating wiki walls and virtual boards		
Social media services		
Services for conducting online meetings and conferences		

Source: Own development

Table 3. Questionnaire for research participants (Stage 2)

Which of the popular WEB 2.0 services have you implemented in online training courses?											
1. Services for creating and/or storing documents	Google Drive	OneDrive	DropBox	Mega	iCloud	pCloud	Ice Drive	SYNC	Nord Locker	Media Fire	Other
Answer (✓)											
2. Services for creating and/ or storing presentations	Microsoft Power Point	Apple Keynote	Google Slides	Canva	Prezi	Haiku Deck	Zoho Show	Visme	Tilda	Slide Dog	Other
Answer (✓)											
3. Services for creating surveys and tests	Google Forms	Survey Monkey	Survio	Typeform	Simpoll	Anketolog	Online Test Pad	Survey Gizmo	EXAMINARE	Other	
Answer (✓)											
4. Services for creating didactic games	Learning apps Online Test Pad	Class Tools	Madtest	Kahoot	Factile	Flippity	ProProfs	Genially	Umaigra	Other	
Answer (✓)											
5. Services for creating mind maps	Xmind	Draw.io	Mindmeister	Simple Mind	Mindjet	iMind Map	Mindmup	Mapul	Mindomo	Other	
Answer (✓)											
6. Services for creating and storing video materials	Vimeo	Kinescope	Boomstream	Wistia		Movavi		Avid Media Composer	Bolide Movie Creator	Other	
Answer (✓)											
7. Services for creating and storing photos and slides	Flickr	Google Photos	Photobucket	Amazon Prime Photos		ThisLife	PostImage	TinyPic	Free Image Hosting	Other	
Answer (✓)											
8. Services for creating blogs	Word Press	Wix	Tilda	Blogger	Telegram	Live Journal	Type Pad Micro	Jux	Posterous Spaces	Blogetery	Weebly	Other
Answer (✓)											
Services for creating wiki walls and virtual boards	Flock Draw	Popplet	Realtime Board		Rizzoma	Scrumlr	Twiddla	Vyew	WikiWall	Padlet	Other
Answer (✓)											
Social media services	Facebook	YouTube	Instagram		LinkedIn	Tik Tok	Twitter	Snapchat	Classmates	WeChat	Vkontakte	Other
Answer (✓)											
Services for conducting online meetings and conferences	Zoom	G Suite Hangouts / Meet	Microsoft Teams		Viber	Go To Meeting	Slack	Uber Conference	Facebook Messenger Room	Click Meeting	Pexip	Other
Answer (✓)											

Source: Own development

itself to finding optimal digital solutions to ensure adequate technological support for educational interaction in the context of distance learning in the COVID-19 era. The study's main limitations are its small sample size (58 teachers) and the small number of online services being analyzed. Since the study only included two Russian universities, the findings do not reflect the general dynamics in the Russian Federation.

RESULTS AND DISCUSSION

Feasibility of Implementing Web 2.0 Services in Practical Educational Activities During the Pandemic

The solution to the study's first task set is based on two main components. On the one hand, it relies on the analysis of academic literature and research presented in the Introduction and Literature Review sections. On the other hand, it is informed by the results of the first set of surveys. This survey provided essential details about actual educational practices using Web 2.0 mechanisms and tools during COVID-19 restrictions.

The COVID-19 pandemic changed pedagogical approaches and vocational training methods by shifting most educational activities online. Developing professional competencies requires practice, which caused difficulties in the transition to distance learning. In this regard, optimal technological solutions that contribute to high-quality educational activities in a virtual learning environment must be found at all stages of designing online courses.

Based on an analysis of teaching practices, our study participants, who are educators, indicated that using Web 2.0 services in the educational process contributes to the development of students' professional competencies. Nevertheless, not all capabilities of modern online services adapted to educational goals are used in practical pedagogy.

The Main Types of Web 2.0 Services Adaptive to Educational Goals

Based on the results of the first survey, which considered the pedagogical experience of using Web 2.0 services in the context of the transition to distance learning associated with the pandemic, the following conclusions can be drawn:

- The Web 2.0 services most often used by teachers at the stages of modeling educational activities in distance learning include social networks and videoconferencing services.
- Services allowing users to create and store videos, photos, and slides were less often used.
- The majority of teachers used services for creating blogs (52 people), services for creating surveys and tests (50 people), services for creating wiki walls and virtual boards (46 people), services for creating mind maps (33 people), and services for creating didactic games (41 people).
- At the stage of developing educational content and implementing educational activities, the teachers used services for creating and storing documents (50 people) and services for creating and storing presentations (56 people).

Survey Findings Among Teachers

The results of the first survey are described in Table 4.

The results of the second survey allowed us to determine the Web 2.0 services most popular among teachers during the pandemic.

All respondents used social networking and videoconferencing services; the most popular ones were Facebook, YouTube, Instagram, Twitter, Vkontakte, Zoom, Microsoft Teams, Viber, GoToMeeting, Slack, and UberConference.

At the stages of modeling educational content and implementing pedagogical activities, most teachers relied on services for creating and storing documents, such as Google Drive, Mega, and iCloud, and services for creating and storing presentations, such as Apple Keynote, Google Slides, and Canva.

Many teachers introduced gamification elements into their teaching activities with the help of services for creating didactic games, such as Learningapps Online Test Pad, ClassTools, Madtest, and Kahoot. In addition, they used services for creating mind maps, including Xmind, MindMeister, Mindjet, and iMindMap.

Table 4. The results of the first survey

The use of WEB 2.0 services by teachers in their pedagogical activities in the context of the transition to distance learning associated with the pandemic		
	Answer option (✓)	
	Yes	**No**
Services for creating and/or storing documents	50 people	8 people
Services for creating and/or storing presentations	56 people	2 people
Services for creating surveys and tests	50 people	8 people
Services for creating didactic games	41 people	17 people
Services for creating mind maps	33 people	25 people
Services for creating and storing video materials	21 people	37 people
Services for creating and storing photos and slides	18 people	40 people
Services for creating blogs	52 people	6 people
Services for creating wiki walls and virtual boards	46 people	12 people
Social media services	58 people	-
Services for conducting online meetings and conferences	58 people	-

Source: Own development

Respondents used services for creating and storing videos, photos, and slides less often; Vimeo, Google Photos, and Amazon Prime Photos appeared to be the most popular.

The most popular services for creating blogs included WordPress, Blogger, Blogetery, and Weebly, and services for creating wiki walls and virtual boards were FlockDraw, RealtimeBoard, and WikiWall.

Table 5 shows the results of the second survey.

In the context of distance learning in the COVID-19 era, educators face the challenge of developing high-quality educational content and ensuring interactive educational interaction of students using up-to-date online services. At the same time, students must possess a high level of self-management, self-discipline, involvement, and motivation. Within the framework of modern realities, educators must find and apply educational models that contribute to realizing an effective educational process. One such model is the andragogical model of learning. In this adult learning model, the student is actively involved in building an educational strategy and implementing a training program. At the same time, much attention is paid to group educational interactions in an informal atmosphere based on teamwork, support, and personal responsibility of all participants in the educational process. The principles of structuring the educational process within the andragogical model are described in Figure 2.

During the third stage of the experiment, we asked the teachers to assess the degree to which Web 2.0 services assist in the implementation of the principles of andragogy on a 10-point scale (Table 6).

The survey results demonstrated the positive contribution of modern online services used in education. According to the teachers, integrating WEB 2.0 services into educational activities prioritizes self-instructional models and stable personal growth and development (45 respondents). It promotes the transformation of practical experience into knowledge (39 respondents). Digital services provide good opportunities for learning by doing (57 respondents) and social and group interaction (58 respondents). They can personalize learning and ensure an individualized approach to each student (49 respondents). To a large extent, online services encourage students to focus on the result (47 respondents) and influence their degree of self-motivation (43 respondents).

Table 5. Results of the second survey

The most popular WEB 2.0 services among teachers at the implementation stage of distance learning in the context of the COVID-19 pandemic											
1. Services for creating and/or storing documents	Google Drive	One Drive	DropBox	Mega	iCloud	pCloud	Ice Drive	SYNC	Nord Locker	Media Fire	Other
	✓			✓	✓						
2. Services for creating and/or storing presentations	Microsoft Power Point	Apple Keynote	Google Slides	Canva	Prezi	Haiku Deck	Zoho Show	Visme	Tilda	Slide Dog	Other
		✓	✓	✓							
3. Services for creating surveys and tests	Google Forms	Survey Monkey	Survio	Typeform	Simpoll	Anketolog	Online Test Pad	Survey Gizmo	EXAMINARE	Other	
4. Services for creating didactic games	Learning apps Online Test Pad		ClassTools	Madtest	Kahoot	Factile	Flippity	ProProfs	Genially	Umaigra	Other
	✓		✓	✓	✓						
5. Services for creating mind maps	Xmind	Draw.io	Mindmeister	Simple Mind	Mindjet	iMindMap	Mindmup	Mapul	Mindomo	Other	
	✓		✓		✓	✓					
6. Services for creating and storing video materials	Vimeo	Kinescope	Boomstream	Wistia	Movavi	Avid Media Composer		Bolide Movie Creator		Other	
	✓										
7. Services for creating and storing photos and slides	Flickr	Google Photos	Photobucket	Amazon Prime Photos	This Life	PostImage	TinyPic	Free Image Hosting		Other	
		✓		✓							
8. Services for creating blogs	WordPress	Wix	Tilda	Blogger	Telegram	Live Journal	Type Pad Micro	Jux	Posterous Spaces	Blogetery	Weebly
	✓			✓						✓	✓
Services for creating wiki walls and virtual boards	FlockDraw	Popplet	Realtime Board	Rizzoma	Scrumlr	Twiddla	Vyew	Wiki Wall	Padlet	Other	
	✓		✓					✓			
Social media services	Facebook	YouTube	Instagram	LinkedIn	Tik Tok	Twitter	Snapchat	Classmates	WeChat	Vkontakte	Other
	✓	✓	✓			✓				✓	
Services for conducting online meetings and conferences	Zoom	G Suite Hangouts / Meet	Microsoft Teams	Viber	Go To Meeting	Slack	Uber Conference	Facebook Messenger Room	Click Meeting	Pexip	Other
	✓		✓	✓	✓	✓	✓				

Source: own development

Figure 2. Principles of structuring the educational process in andragogy (Source: Own development)

Table 6. Web 2.0 services' degree of assistance in the implementation of the principles of andragogy on a ten-point scale

Principle	Degree of Assistance		
	Poor (0–4)	Great (5–7)	Full (8–10)
Self-study, stable personal growth and development		45 people	13 people
Transforming practical experience into knowledge	2	39	17
Learning by doing		2	57
Social, group learning			58
Personification and individual approach		9	49
Learning effectiveness	9	43	6
Focus on the result		47	13
Self-motivation of the learner	4	43	11

Source: Own development

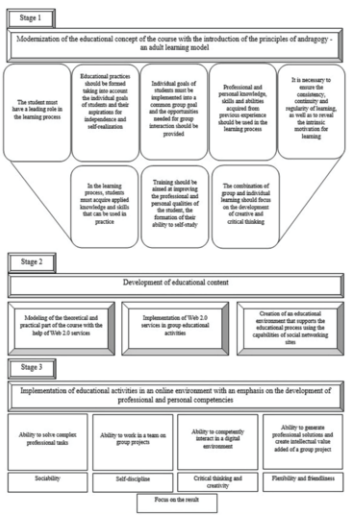
In the context of physical distancing and social restrictions, digital services and online communication platforms make it possible to implement educational activities at a high pedagogical level, ensuring participants' high-quality educational interaction within the educational process.

Model of an Effective Educational Process in the Pandemic Context

Based on our findings, we developed a model of an effective educational process in the context of the COVID-19 pandemic (Figure 3).

In the extreme situation of the COVID-19 pandemic, higher educational institutions were forced to review their policies and introduce innovations. For example, students and teachers at the University of Zimbabwe used WhatsApp to communicate during the pandemic (Tarisayi & Munyaradzi, 2021). The application proved a simple and convenient solution for teachers and students, allowing them to maintain interaction when face-to-face meetings were banned due to the isolation rules. The integration of WhatsApp into the postgraduate program supported synchronous and asynchronous learning.

Figure 3. Model of an effective educational process in the COVID-19 pandemic context (Source: Own development)



The lecturers used the WhatsApp platform to deliver lessons through group video calls and to share PowerPoint presentations, audio tracks, and portable document format files. The participants had a positive experience integrating WhatsApp into teaching and learning, and their previous exposure to WhatsApp as a communication platform was instrumental in integrating WhatsApp into teaching and learning. A consensus emerged among the participants in the educational process on the vital role of WhatsApp in breaking the social vacuum created by the COVID-19 restrictions imposed by the government (Tarisayi & Munyaradzi, 2021).

To investigate the effectiveness of using Facebook Groups in distance learning as an alternative to various learning management systems, especially during the COVID-19 pandemic, Avila and Cabrera (2020) conducted a study among students at Camarines Sur Polytechnic College in the Philippines. The results showed that using a Facebook Group in virtual classrooms significantly improved students' academic performance compared to those trained using a modular approach. In addition, the students realized that Facebook can be used as a learning tool, and its integration is a more accessible, flexible, cheaper, and more convenient way to deliver lessons while being isolated due to COVID-19 (Avila & Cabrera, 2020).

Mbabazi et al. (2020) conducted a study among engineering students at Mooney University in Uganda to determine their attitudes toward using Web 2.0 technologies for learning outside the classroom. The questionnaire results showed that students' behavioral intention to use Web 2.0 services depends on the expected academic performance, expected effort, social impact, and presence of a supportive environment. The study also found that students use YouTube, Facebook, and Google Apps more often than LinkedIn, social bookmarking, vlogging, Flickr, Moodle, Zoom, Wiki Spaces, Edx, MIT Courseware, TED-Ed, Endnote, and Dropbox. Thus, these apps are vital to learning, especially during and after the global restrictions and social distancing caused by COVID-19 (Mbabazi et al., 2020).

Web 2.0 has revolutionized the Internet and how we use it, improving the discovery, retrieval, and aggregation of information, content management, content structuring, web technologies, applications, communications, marketing, and sales. While these improvements provide significant benefits, they also threaten fundamental security and privacy requirements (Saqib et al., 2021). The COVID-19 outbreak increased the need for quality assurance of distance learning interactions. Despite the apparent benefits, Web 2.0 integration into education is a matter of concern for students, educators, and educational institutions. For example, students must have self-regulation skills and technological competence as they must manage and conduct studies at their own pace, independently of the teacher, and use online technologies during personal studies (Rasheed et al., 2020). An analysis of the learning experience during COVID-19 in the UK revealed a significant dependence on technological devices during online learning (Toheeb, 2020). However, a lack of computer skills and a relatively higher workload prevented students from successfully adapting to distance learning. During isolation, students were most worried about their future careers and academic problems (Toheeb, 2020). A study of the challenges and benefits of learning based on Web 2.0 among international ESL students at the Eastern Mediterranean University (EMU) in Northern Cyprus showed that the challenges faced by international students during the COVID-19 pandemic include a lack of digital competence and technical problems such as poor internet connection, inability to download large files, and loss of passwords (Hassan et al., 2021). In addition, the study found that Web 2.0 technologies can help students improve collaborative learning, independent learning, flexible learning, and technology-related learning skills (Hassan et al., 2021).

Based on the implementation of Chinese lifelong learning principles during COVID-19, Huang et al. (2020) identified the following seven pillars of effective online education in emergencies: 1) ensuring a reliable network infrastructure; 2) relying on user-friendly learning aids; 3) providing suitable interactive digital learning resources, such as online video micro-courses, e-books, simulations, animations, quizzes, and games; 4) providing group and individual recommendations to students on the use of effective learning methods; 5) promoting effective learning management methods by adopting a range of learning strategies, such as case studies, open debate, discussion,

and experiential learning; 6) providing instant teacher and student support services using effective learning technologies, tools, and resources; and 7) expanding opportunities for partnerships between authorities, business structures, and educational institutions. Finally, more inclusive authoring tools with various functionalities should be developed so educators can use them to create accessible digital learning resources (Huang et al., 2020).

In 22 universities in Saudi Arabia, Aldhahi et al. (2022) examined the relationship between self-efficacy of online learning and student satisfaction with online learning during the emergency transition to distance learning. The researchers determined that the level of self-efficacy in e-learning affects student satisfaction with the e-learning process (Aldhahi et al., 2022). Integrating mobile technology and Web 2.0 services into student learning and assessment presents opportunities and challenges and, therefore, requires rethinking the pedagogical structures these tools are based on. Thus, understanding the relationship between mobile learning and basic psychological needs will lead to more encouraging mobile learning design strategies (Nikou & Economides, 2021).

In any crisis, such as a pandemic, war, or natural disaster, online learning largely meets the academic needs of students, but several challenges must be considered and addressed. Developed countries may have the advantage of launching emergency online and distance learning during the crisis phase, but the same may not apply to all countries worldwide. For example, Bordoloi et al. (2021) point out that in India, several variables should be considered before implementing certain online activities, including target students' social, cultural, and economic backgrounds, age range, and access to technology, as well as educational institutions' technological readiness. In addition, issues such as the digital divide between the rich and the poor must be seriously addressed. While many countries suffer from educational disruptions, in India, the digital divide is still one of the greatest threats to effective online learning. In this regard, the systematic integration of technology into teaching and learning in higher educational institutions through policy implementation, capacity building, and appropriate low-cost technologies can herald constructive changes (Bordoloi et al., 2021).

Research Implications

Foremost among the survey findings is the discernible enhancement in the quality of distance learning through the utilization of the described services. Instructors highlight that social networks and virtual meeting platforms are the most prevalent tools, underscoring the imperative for integrating contemporary technologies into educational curricula to ensure more effective and engaging instruction. Another crucial implication is the need to cultivate digital skills among educators and students. Incorporating digital tools into the educational system elevates the quality of education and fosters the development of digital competence, a pivotal asset in the modern world. Additionally, the research results have substantial implications for educational policies, which must be revised to support the use of innovative digital tools and provide essential resources for their effective implementation. Furthermore, this research contributes to adapting educational programs in response to the evolving landscape of digital education.

Considering the advantages of Web 2.0, educational programs can be reviewed and adapted to incorporate these technologies, thereby rendering education more flexible and individualized. Ultimately, the use of Web 2.0 in education fosters inter-university collaboration, opening new avenues for joint projects and the exchange of expertise while supporting continuous and self-directed learning among students. Overall, the research findings underscore the importance of integrating modern technologies into the educational process, a pivotal step in adapting to evolving demands and challenges in the contemporary educational landscape.

CONCLUSION

Quarantines and campus closings transformed teaching and learning, leading to a shift to distance learning and the use of online platforms, media, mobile applications, and social networking sites

to enable collaboration in virtual learning. Because developing professional competencies requires practice, in the context of the pandemic, teachers have been searching for optimal technological solutions that contribute to high-quality educational activities in a virtual learning environment.

The results of the study of the pedagogical experience of interacting with WEB 2.0 services in the context of distance learning in the COVID-19 era also reveal the possibilities of using Web 2.0 services to provide effective technological support for educational interactions while performing practical learning tasks.

The analysis of the pedagogical experience confirmed that implementing Web 2.0 services in educational processes can ensure high-quality digital pedagogy. Nevertheless, not all capabilities of modern online services adapted to educational goals are used in practical pedagogy. The most popular Web 2.0 services used by teachers during the COVID-19 pandemic include 1) social networking services (Facebook, YouTube, Instagram, Twitter, Vkontakte); 2) videoconferencing services (Zoom, Microsoft Teams, Viber, GoToMeeting, Slack, UberConference); 3) services for creating and storing documents (Google Drive, Mega, iCloud); 4) services for creating and storing presentations (Apple Keynote, Google Slides, Canva); 4) services for creating didactic games (Learningapps Online Test Pad, ClassTools, Madtest, Kahoot); 5) services for creating mind maps (Xmind, Mindmeister, Mindjet, iMindMap); 6) services for creating and storing videos, photos and slides (Vimeo, Google Photos, Amazon Prime Photos); 7) blogging services (WordPress, Blogger, Blogetery, Weebly); and 8) services for creating wiki walls and virtual boards (FlockDraw, RealtimeBoard, WikiWall).

In this paper, we described a model of an effective educational process in the context of the COVID-19 pandemic by emphasizing the development of high-quality educational content and ensuring students' educational interaction through Web 2.0 tools. At the first stage of the educational process, it is necessary to modernize the educational concept of the course and introduce the principles of andragogy, an adult learning model in which the student has a leading role in the learning process. Educational practices should be formed considering students' individual goals and aspirations for independence and self-realization. Students' individual goals must be combined into a shared group goal, and the opportunities needed for group interaction should be provided. Professional and personal knowledge, skills, and abilities acquired from previous experience should be used in the learning process. It is necessary to ensure the consistency, continuity, and regularity of learning and to reveal the intrinsic motivation for learning. In the learning process, students must acquire applied knowledge and skills that can be used in practice. Training should be aimed at improving students' professional and personal qualities and forming their ability to self-study. Group and individual learning should focus on developing creative and critical thinking. When developing online learning content, Web 2.0 tools should be implemented in the theoretical and practical parts of the course, and a communication environment that supports the educational process should be created using the capabilities of social networking sites. When implementing educational activities in an online environment, it is necessary to focus on the development of professional and personal competencies, namely the ability to solve complex professional problems, work in a team on group projects, interact competently in the digital environment, and generate professional solutions and create intellectual added value in group projects. In the learning process, students must acquire communication skills, self-discipline, critical thinking and creativity, flexibility and friendliness, and commitment to the result.

Prospects for further research are related to the study of the functionality of Web 2.0 services at the stages of modeling effective learning courses within the framework of digital pedagogy.

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REFERENCES

Akhitova, R. (2023). Kaizen continuous improvement technology in the educational process of future computer science teachers: A case study in Kazakhstan. *Global Journal of Engineering Education*, *25*(3), 163–170. http://www.wiete.com.au/journals/GJEE/Publish/vol25no3/03-Akhitova-R.pdf

Ala, O. G., Yang, H., & Ala, A. A. (2023). Leveraging integrated peer-assisted learning clusters as a support for online learning. *Interactive Learning Environments*, *31*(6), 3744–3756. doi:10.1080/10494820.2021.1943454

Aldhahi, M. I., Alqahtani, A. S., Baattaiah, B. A., & Al-Mohammed, H. I. (2022). Exploring the relationship between students' learning satisfaction and self-efficacy during the emergency transition to remote learning amid the coronavirus pandemic: A cross-sectional study. *Education and Information Technologies*, *27*(1), 1323–1340. doi:10.1007/s10639-021-10644-7 PMID:34276239

Alsoud, A. R., & Harasis, A. A. (2021). The impact of COVID-19 pandemic on student's e-learning experience in Jordan. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(5), 1404–1414. doi:10.3390/jtaer16050079

Avila, E. C., & Cabrera Jr, H. I. (2020). The use of Facebook group in distance learning during the time of COVID-19 pandemic. *PalArch's Journal of Archaeology of Egypt/Egyptology, 17*(6), 1859–1871.

Bamoallem, B., & Altarteer, S. (2022). Remote emergency learning during COVID-19 and its impact on university students perception of blended learning in KSA. *Education and Information Technologies*, *27*(1), 157–179. doi:10.1007/s10639-021-10660-7 PMID:34276241

Bassani, P. B. S., & Barbosa, D. N. F. (2018). Experiences with web 2.0 in school settings: A framework to foster educational practices based on a personal learning environment perspective. *Educação em Revista*, *34*(0), e162010. doi:10.1590/0102-4698162010

Bordoloi, R., Das, P., & Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: An academic analytics in the Indian context. *Asian Association of Open Universities Journal*, *16*(1), 41–60. doi:10.1108/AAOUJ-09-2020-0079

Cavus, N., Sani, A. S., Haruna, Y., & Lawan, A. A. (2021). Efficacy of social networking sites for sustainable education in the era of COVID-19: A systematic review. *Sustainability (Basel)*, *13*(2), 808. doi:10.3390/su13020808

Chisag, J. C. C., Díaz, N. C. G., Calderon, F., Cruzado, F., Pisuna, F., Carate, M., Baylón, A. R., & Ortiz, O. L. G. (2020). The technology acceptance model in the Collaborative learning of Web 2.0, Web 3.0 and Web 4.0: Higher education case study. *WSEAS Transactions on Environment and Development*, *16*, 680–688. doi:10.37394/232015.2020.16.70

Doung-In, S. (2018). Exploring the awareness and use of Web 2.0 tools by the first year information science students, Walailak University, Thailand. *International Journal of Information and Education Technology (IJIET)*, *8*(4), 279–284. doi:10.18178/ijiet.2018.8.4.1048

Gerasimova, E. K. (2021). Implementation of training using electronic learning materials based on Web 2.0 online services. In *Proceedings of the IV All-Russian Scientific and Practical Conference with International Participation "Distance Learning Technologies" (DLT 2019)* (*Vol. 2834*, pp. 137–147). CEUR Workshop Proceedings. https://ceur-ws.org/Vol-2834/Paper12.pdf

Hassan, I., Bara, U., Gamji, M., Yahaya Nasidi, Q., & Latiff Azmi, M. N. (2021). Challenges and benefits of web 2.0-based learning among international students of English during the Covid-19 pandemic in Cyprus. *Arab World English Journal*, *1*(1), 295–306. doi:10.24093/awej/covid.22

Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., & Wang, H. H. (2020). *Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining undisrupted learning in COVID-19 outbreak*. Smart Learning Institute of Beijing Normal University.

Iivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? *International Journal of Information Management*, *55*, 102183. doi:10.1016/j.ijinfomgt.2020.102183 PMID:32836640

Karakas, A., & Kartal, G. (2020). Pre-service language teachers' autonomous language learning with Web 2.0 tools and mobile applications. *International Journal of Curriculum and Instruction*, *12*(1), 51–79.

Kazhan, Y. M., Hamaniuk, V. A., Amelina, S. M., Tarasenko, R. O., & Tolmachev, S. T. (2020). The use of mobile applications and Web 2.0 interactive tools for students' German-language lexical competence improvement. In *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)* (Vol. 2643, pp. 392–415). CEUR Workshop Proceedings. https://ceur-ws.org/Vol-2643/paper23.pdf

Mathrani, A., Han, B., Mathrani, S., Jha, M., & Scogings, C. (2021). Interpreting academic integrity transgressions among learning communities. *International Journal for Educational Integrity*, *17*(1), 1–16. doi:10.1007/s40979-021-00073-x

Mbabazi, P. B., Nkamwesiga, N., Nafuna, R., & Kyomugisha, P. (2020). Web 2.0 students adoption model for learning in universities: A case of Muni University, Uganda. *International Journal for e-Learning Security, 9*(1), 624–630.

Molnár, G., Szűts, Z., & Balogh, Z. (2019, September). Modern digital Web 2.0 devices and services supporting the teaching of technology and informatics. In *Proceedings of the 2019 IEEE 17th International Symposium on Intelligent Systems and Informatics (SISY)* (pp. 89–94). IEEE. doi:10.1109/SISY47553.2019.9111555

Nachmias, S., & Hubschmid-Vierheilig, E. (2021). We need to learn how to love digital learning "again": European SMEs response to COVID-19 digital learning needs. *Human Resource Development International*, *24*(2), 123–132. doi:10.1080/13678868.2021.1893503

Nikou, S. A., & Economides, A. A. (2021). A framework for mobile-assisted formative assessment to promote students' self-determination. *Future Internet*, *13*(5), 116. doi:10.3390/fi13050116

Ofcom. (2020). *Online Nation 2020 Report*. Online Nation 2020. https://www.ofcom.org.uk/__data/assets/pdf_file/0027/196407/online-nation-2020-report.pdf

Ohei, K. N., & Brink, R. (2019). Web 3.0 and Web 2.0 technologies in higher educational institute: Methodological concept towards a framework development for adoption. [IJI]. *International Journal for Infonomics*, *12*(1), 1841–1853. doi:10.20533/iji.1742.4712.2019.0188

Phadnis, R., Wickramasinghe, C., Zevallos, J. C., Davlin, S., Kumarapeli, V., Lea, V., Lee, J., Perera, U., Solórzano, F. X., & Vásconez, J. F. (2021). Leveraging mobile phone surveys during the COVID-19 pandemic in Ecuador and Sri Lanka: Methods, timeline and findings. *PLoS One*, *16*(4), e0250171. doi:10.1371/journal.pone.0250171 PMID:33857226

Purvis, A. J., Rodger, H. M., & Beckingham, S. (2020). Experiences and perspectives of social media in learning and teaching in higher education. *International Journal of Educational Research Open*, *1*, 100018. doi:10.1016/j.ijedro.2020.100018

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. *Computers & Education*, *144*, 103701. doi:10.1016/j.compedu.2019.103701

Rospigliosi, P. A. (2019). The role of social media as a learning environment in the fully functioning university: Preparing for generation Z. *Interactive Learning Environments*, *27*(4), 429–431. doi:10.1080/10494820.2019.1601849

Saqib, N. A., Salam, A. A., Atta-Ur-Rahman, , & Dash, S. (2021). Reviewing risks and vulnerabilities in Web 2.0 for matching security considerations in Web 3.0. *Journal of Discrete Mathematical Sciences and Cryptography*, *24*(3), 809–825. doi:10.1080/09720529.2020.1857903

Shugaeva, E., Bogatyreva, S., Shumakova, S., & Sinitsyna, I. (2021). Web 2.0 services and organization of interactive distance learning of a foreign language. In *Proceedings of the Third Annual International Symposium "Education and the City: Education and Quality of Living in the City" (Education and City 2020)* (Vol. 98, p. 05038). EDP Sciences: SHS Web of Conferences. doi:10.1051/shsconf/20219805038

Sönmez, E. E., & Çakır, H. (2021). Effect of Web 2.0 technologies on academic performance: A meta-analysis study. *International Journal of Technology in Education and Science*, *5*(1), 108–127. doi:10.46328/ijtes.161

Tarisayi, K. S., & Munyaradzi, E. (2021). A simple solution adopted during the Covid-19 pandemic: Using WhatsApp at a university in Zimbabwe. *Issues in Educational Research*, *31*(2), 644–659. http://www.iier.org.au/iier31/tarisayi.pdf

Thaariq, Z. Z. A. (2020). The use of social media as learning resources to support the new normal. *Teknodika*, *18*(2), 80–93. doi:10.20961/teknodika.v18i2.42181

Vargo, D., Zhu, L., Benwell, B., & Yan, Z. (2021). Digital technology use during COVID-19 pandemic: A rapid review. *Human Behavior and Emerging Technologies*, *3*(1), 13–24. doi:10.1002/hbe2.242

Williams, M. L. (2020). The adoption of Web 2.0 technologies in academic libraries: A comparative exploration. *Journal of Librarianship and Information Science*, *52*(1), 137–149. doi:10.1177/0961000618788725

Xu, X. (2021). Research on online training for university faculties in the Web 2.0 era. *Open Journal of Social Sciences*, *9*(6), 64–68. doi:10.4236/jss.2021.96007

Zakota, Z. (2020). Analysing Web 2.0 usage of high school students in the Partium region before the Covid-19 pandemic. In *Proceedings of the ENTRENOVA—ENTerprise REsearch InNOVAtion Conference, Virtual Conference* (*Vol. 6*, pp. 258–264). IRENET—Society for Advancing Innovation and Research in Economy. https://proceedings.entrenova.org/entrenova/article/view/328

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