Educational Technology 'Introduced' by the COVID-19 Pandemic

Tecnología educativa 'introducida' por la pandemia COVID-19

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ABSTRACT

As society scrambled to adjust to life amidst the COVID-19 pandemic, new and unprecedented challenges presented themselves within all walks of life. The pressure to adapt the delivery of education within restricted societies fell mainly on the shoulders of teachers. The purpose of the article is a positive know-how transfer with the educational technology use in and out of pandemic times. The article is based on two qualitative content analyses of teacher-chosen technology. One content analysis, done via corpus linguistic analysis, provided data for EXCEL computation to quantitatively calculate the frequency of educational technology usage. The second content analysis resulted in thematic clusters of educational technology based on its function. The study shows that distance learning has gone through many changes 'caused' by the COVID-19 pandemic. Technology has helped education to continue despite the loss of physicality, and educational technology, especially the web-based software solutions, enabled educators to reach, keep or even improve the quality of teaching and learning. In comparison to the past, in which mostly asynchronous distance learning tools were used, the pandemic increased the usage of collaborative, communicative, interactive synchronous tools and portable devices. It also increased the variety of educational software solutions. For the same or similar functions, more tools are now available. The article works with a vast amount of data in which teachers, teacher trainers, students, interested laypeople, and others from all over the world answered the question: "What educational technology do you use?" and can therefore offer suggestions for global teaching praxis.

KEYWORDS Asynchronous communication; synchronous communication; distance education; educational technology; pandemics.

RESUMEN

Vinculado al intento de la sociedad de ajustarse a la pandemia de la Covid-19, han surgido nuevos retos en todas las esferas de la vida. La presión de adaptar la labor educativa en una sociedad con restricciones fue, mayoritariamente, tarea del personal docente. El objetivo del presente artículo es realizar una trasferencia positiva del conocimiento de la tecnología educativa, tanto dentro como fuera de los tiempos de la pandemia. El artículo presenta dos análisis cualitativos sobre la preferencia de la tecnología por parte de los docentes. El primero se basa en la interpretación de los datos recogidos, sometidos a cálculo cuantitativo con el software EXCEL, para conseguir las frecuencias de uso de una u otra tecnología. El segundo análisis interpreta la tecnología por grupos temáticos, basados en su función. El estudio muestra que la educación/enseñanza a distancia ha pasado por muchos cambios causados por la pandemia. La tecnología ayudó a la educación/enseñanza a continuar a pesar de la pérdida de lo físico, y la tecnología educativa, especialmente las soluciones basadas en páginas web, han facilitado a los docentes el camino a seguir para mantener y mejorar la calidad del mismo proceso educativo. Comparando con el pasado durante el cual los instrumentos de educación a distancia se habían

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utilizado asincrónicamente, la pandemia ha posibilitado el uso de posibilidades interactivas y portátiles más colaborativa y comunicativas. También ha incrementado la variedad de los propios instrumentos. Ahora existe más de una solución para cubrir la misma o parecida función. El artículo trabaja una extensa cantidad de datos para responder la pregunta "¿qué tecnología educacional empleas?". Las respuestas las facilitaron profesores, maestros, entrenadores, estudiantes y otras personas interesadas, todo ello para poder ofrecer luego sugerencias para la práctica de una enseñanza más global.

PALABRAS CLAVE Comunicación sincrónica; comunicación asincrónica; educación a distancia; tecnología educacional; pandemia.

1. INTRODUCTION

Technology has gradually found its way into our classrooms. In some cases, it has taken years for the technology to become educational technology. With the onset of the COVID-19 pandemic, the urgency of shifting into a virtual space catalysed in educators attempting to master such technology overnight. During the pandemic, with schools being severely restricted in their face-to-face delivery, the development of educational technologies has accelerated. New apps/websites/software solutions appeared, old ones improved, the worldwide teaching community shared online tools and platforms to transfer the positive know-how, i.e. how to work in the forced online environment in the most effective and beneficial way. Technological developments made the use of online communication tools, learning/teaching applications, and collaborative tools possible. But the shift was rushed.

Amidst COVID-19's "new normal", with the onset of the pandemic, many researchers tried to target the topic of educational technology and its role in education" from various (new) points of view. Researchers investigated synchronous versus asynchronous modes of delivery (Dincher, & Wagner, 2021; Koutska, & Biniek, 2021); (new) necessary skills and competences one has to master for online learning/teaching (Al Lily *et al.*, 2020; Guillén-Gámez *et al.*, 2021; Onyema *et al.*, 2020); teachers' perspectives of the impact of the pandemic on education (Lapada *et al.*, 2022); and unparalleled solidarity within the teaching community regarding the sharing of ideas, tools, plans, and know-how (Shaffhauser, 2020).

The presented research paper aims at continuing this solidarity of the sharing by presenting a by-global-users-justified list of to be used educational technology. The purpose of the present study is to understand the educational tools most frequently used in a global context before and during the COVID-19 pandemic restrictions (2019-2021).

Specifically, two research questions were addressed. The first involves soliciting the specific educational technologies used during the pandemic times and their frequency of use. The second involved understanding the function served by the technologies.

1.1. Literary Review

One of the most discussed aspects of educational technology usage in the COVID-19 pandemic times has been the delivery mode. Without the possibility to carry on with on-campus teaching, modalities shifted to those that allowed social distancing, a virus-safe environment, flexibility of use, and (with good quality

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internet connection) reliability (Corpus, 2020; Turnbull *et al*., 2020). The change in educational technology function, i.e. whether with the pandemic-caused shift to online modalities educational technology already available was used differently from the pre-pandemic times or not, was questioned (Abisado, 2020). Comparisons between face-to-face teaching (Abel, 2020; Orr *et al*., 2019; Stone *et al*., 2019), online learning, "emergency online learning" (Ewing, & Cooper, 2021), "emergency remote teaching" (Bozkurt, & Sharma, 2020) and "emergency eLearning" (Murphy, 2020) were made. Teacher preparedness to switch into this enforced virtual teaching modality without any other option (Howard *et al*., 2020) was discussed. "An inability of teacher education programs to build technical knowledge and skills (Fishman, & Davis, 2006), a lack of funding and resources (Nikolopoulou, & Gialamas, 2015), an absence of direction related to e-course design and delivery (Vongkulluksn *et al*., 2018), limited motivational incentives (Scherer *et al*., 2019)" (all in Christopoulus, & Sprangers, 2021) or "new technologies improving and evolving previous applications (Rachad, & Idri, 2020; Wang *et al*., 2020), availability of software applications and operating systems (Almaiah *et al*., 2020), reaction of information technology market and industry plus cybersecurity (Dwivedi *et al*., 2020)" (all in Qiao *et al.*, 2021) were other topics frequently addressed.

The study presented in this paper complements research on trends in educational technology usage due to the pandemic. It questions the statement that "the pandemic increased frequency (but not the nature) of use" (Kimmons *et al*., 2021). From personal educational practice of the researcher, changers were seen in the educational technology on offer, and the frequency and nature of use/function.

1.2. Context

Distance learning originated as a form of instruction for those who could not get access to an/any educational institution. It was used for students from remote areas or for adults (working, on maternity leave, with health issues, etc.) or generally for anyone who could not attend physically for whatever reason. With globalisation, an even broader audience was targeted but the potential had not been fully used until the COVID-19 pandemic. The restrictions in social contacts meant that members of teaching and learning communities, who did not yet know about the distance learning options or did not know how to use them or were previously reluctant to use them, were forced to shift their courses from face-to-face delivery modes regardless of their wishes, opinions, or competences (Vásquez *et al*., 2023).

Historically, distance learning was used mostly asynchronously. Moore (2000, p. 1) reports that "the most popular delivery technologies used were asynchronous Internet instruction (58%), two-way interactive video (54%) and one-way pre-recorded video (47%)". With the in-person: students will meet face to face in the classroom on a set schedule (Yale University, 2021) not allowed, the education went for either remote asynchronous instructional mode: students will not meet face to face but will interact online, or remote synchronous instructional mode: students will meet face to face online on a set schedule. (Yale University, 2021).

The choice of synchronous or asynchronous distance learning has been influenced by a range of factors, for example when a specific age group is targeted, see Dincher and Wagner (2021, p. 465), who observed that elementary teachers used mainly "paper-based assignments, phone calls and e-mails", whereas secondary school teachers used "platforms —uploading learning material via a digital platform, links— teachers sent

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links to third-party learning content to students and e-mails". For older adult courses, see Koutska and Biniek (2021), distance learning as such was used only rarely as social interaction is one of the main benefits of learning in later life.

Nevertheless, generally speaking, due to the pandemic distance learning opened itself to many new students and new teachers. In the past, courses were targeted at "the wealthy niche market who have access to broadband telecommunication systems, video-conferencing and other hi-tech gadgetry" (Moore, 2002, p. 1). The restrictions of classroom access caused massive investments into either IT skills enhancement or into technological equipment including internet (and WIFI) connection improvement because, at the start, (and sadly to say for many countries up until now), "online education was hindered by poor infrastructures including network, power, inaccessibility and unavailability issues and poor digital skills" (Onyema *et al*., 2020, p. 108). See also in Denmark, Slovenia, Norway, Poland, Lithuania, Iceland, Austria, Switzerland and the Netherlands, over 95% of students report that they have a computer to use for working at home, but in Indonesia, it is only 34% there tend to be very large gaps across socio-economic groups. (OECD, 2021)

Despite the problems, distance learning became a 'new reality'. The consequences of 'forced' online learning/teaching have included. "Pressure (the sudden urgency for online education notwithstanding unreadiness); limited cognitive activities (non-pedagogical activities have been cancelled); loss of educational values; lack of training, lack of focus and dependent learners (students forced into self-learning without previous training)" (Al Lily *et al*., 2020, p. 6), and management problems such as "imbalanced student–teacher power relations; imbalanced parent–teacher power relations or large quantities of bureaucracy-related correspondence" (Al Lily *et al*., 2020, p. 6).

With time, education dealt with the disadvantageous situation where teachers "live in a knowledge and information society […] but do not have solid ICT training, which directly affects their teaching" (Guillén-Gámez *et al*., 2021, p. 494) and offered workshops and trainings (at least at some places and to some extent). Besides pre-pandemic "technical skills, such as knowing how to turn the sound up or use Skype or access and use some aspect of their institutions' VLE (Virtual Learning Environment)" (Walker, & White, 2013, p. 137) and "basic ICT competence, specific technical competence for the software, dealing with constraints and possibilities of the medium, online socialisation, facilitating communicative competence, creativity and choice and own style" (Hampel, & Stickler, 2005, in Walker, & White, 2013, p. 138), (new) digital competences were enhanced in the pandemic times.

The pandemic brought other positives into distance learning as well: solidarity among teachers who helped each other and shared an abundance of (new) material. As Shaffhauser (2020, p. 1) points out, "education technology companies have stepped forward to help educators reach students in virtual ways. In many cases, the companies are making their paid services free through the rest of the school year; in other cases, they are lifting limits to services and/or adding premium features to what is free".

Sharing of materials lead logically to numerous sources where "all" possible tools are listed and, or described. In these lists, however, no established classification for computer-based education is followed, given there are numerous potential systems that differ greatly. Alessi and Trollip (1991, in Churchill, 2017, p. 86-87), classified digital educational technology tools into instructional modules or tutorials, drill and practice, simulations, and games. MERLOT (Multimedia Educational Resource for Learning and Online Teaching)

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(ibid.) classified the tools into animation, assessment tool, assignment, case study, collection, development tool, drill and practice, e-portfolio, learning object repository, online course, open journal-article, open text-book, presentation, quiz/test, reference material, simulation, social networking tool, tutorial, workshop and training material. Yale University offers yet another classification: class content and lecture delivery tools, communication tools, collaborative tools, homework/assignment activity tools, exam/assessment tools, feedback/polling tools (Yale University, 2021) or building interactive lessons, teaching tools for classroom management, content sources for teachers, audio-visual design tools, communication and collaboration tools (iSpring Solutions, 2001-2021).

If the infrastructure allowed, see above, the education also made use of portable devices more than ever before because these were at hand for the functions needed, see Quahtan (2020, p. 247):

> To find educational material (73.8%), find and download E-Learning Tools (47.6%), download Podcasts (15.5%), search for information (90.5%), send and receive E-mails (31.0%), listen to online lectures (31.0%), browse Internet (36.9%), connect with social networks (52.4.%), watch YouTube (54.8%), download Music and videos (76.2%), take and share pictures (70.2%) and make calls 64.3%.

To find out what educational technology (and with what function) was specifically 'introduced' by the COVID-19 pandemic, empirical research was carried out and is presented in this text.

2. MATERIAL AND METHOD

2.1. Purpose of the study, research questions, and hypothesis

The ultimate goal of the study was to set up a list of the most useful educational technology for pandemic times (as well as post-pandemic times) with a description of their function, so that every member of the teaching community can find inspiration in what to use and what for.

The specific research questions asked were: Q1 -What educational technology was used in the pandemic times and what was the frequency of their usage? and Q2 -What function did educational technology listed in answer to Q1 serve?

2.2. Design, methods and procedure

The article analyses data from online discussion panels and teachers' fora from 2019 to 2021. The discussion panels were used due to their unrestricted affordances for express opinions, share experiences, and discuss ideas, the same applies to the teachers' fora. Both served as a source for subsequent corpus creation with those entries that addressed the question of educational technology. Another reason for preferring these sources was to target the research on population involved or highly interested in education, changes in education due to COVID-19, especially in the usage of educational technology.

For the research 2674 respondents' answers to the question: *What educational technology do you use?* were incorporated to build a corpus. The respondents represented the population under study. The corpus built out of all entries was further divided into two corpora: non-pandemic related (2346 entries) and

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pandemic related (430 entries; selected sample of 328 entries; for more see Data collection and analysis). In all the corpora a content analysis via the Sketch Engine corpus linguistics tool was carried out to answe Q1 -What educational technology was used in the pandemic times and what was the frequency of their usage?

The data were further analysed to research functional usage of educational technology for pandemic and non-pandemic periods, i.e. to answer Q2 - What function did educational technology listed in answer to Q1 serve? Categories were created to sum up the function of educational software solution under a hierarchically higher comprehensive heading resulting in: academic tools, audio/visual making tools, communication tools, gamification tools, presentation tools, realia, plus the extra category of TEFL (Teaching English as a Foreign Language) materials.

2.3. Sample

The respondents of the study were pre-service teachers (i.e. teacher trainees=students of teacher training programs), in-service teachers, mostly English as a second language (ESOL) teachers and teacher trainers, mostly Teaching English as a second language (TESOL) teacher trainers, as well as laypeople interested in (ESOL) education from all around the world.

The majority of respondents came from the Philippines (929), followed by Mongolia (172), Brazil (158), Pakistan (156) and India (140). Altogether, 128 countries were represented.

2.4. Instrument

For the data-collection process no specific calibration was used. Internal validity of the research was, however, enhanced by the use of the corpus linguistic tool alongside the human researcher lead content analysis. The research design limitation is especially in the creation of the subset 'in the pandemic times' which is based on the pre-defined code words. The final number of analysed data (328) allows, however, to accept the research results as transferable to other contexts.

2.5. Data collection and analysis

Altogether 2674 respondents' answers were analysed. The complete data set (AB) was narrowed to a subset 'in non-pandemic times' (A) made of 2,346 answers and the subset 'during the pandemic' (B) made of 430 respondents' answers. The code words for pandemic-related categorization were pandemic/epidemic (168); covid/covid-19 (117); corona/korona/virus (68); lockdown/restriction/closure (39); quarantine (38) (the number shows raw frequency). Possibly, some other terms could have distinguished the entry as being pandemic-related but these were chosen as most distinctive. The respondents were participating through their own choice in online educational fora so no consent on research participation was needed as the data were accessible globally.

The excessive amount of data was organized into three sets. One set was represented by the whole corpus, the other two by its proportion categorized as non-pandemic related or pandemic-related. Further reduction followed with those including more than one of the pandemic-related code words (95) and code-words used in different meaning (7) subtracted, to form a selected sample of 328 entries.

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3. RESULTS

The research results are aggregated for the respective sets, i.e. the whole data set (AB), reduced non-pandemic subset (A), and reduced-pandemic-related subset (B).

In terms of both, pandemic or non-pandemic usage of educational technology, the respondents mirrored high prevalence toward Google Suite. The Google Suite tools were analysed therefore separately from 'the others' due to this frequency disproportion. The frequency of Google plus platform/tool/resource/app, and similar general terms was not analysed as these are not examples of a particular educational technology software tool to be used in the (teaching) praxis.

TABLE 1. Raw frequency of Google Suite tools usage.

EDUCATIONAL TECHNOLOGY	AB	A	B	% B/AB
Google Doc/Docs/Document	930	799	131	14.09
Google Forms	893	751	142	15.90
Google Classroom	173	115	58	33.53
Google Drive	35	31	4	11.43
Google Meet	23	14	9	39.13
Google Slides	13	13	0	0

By extracting minimum and maximum, i.e. Google Slides, Google Hangouts, Google Scholar, and Google Earth, one can say that in the pandemic times there was a distinctive increasement in Google Classroom —a communication tool/online learning platform (by 33.53%) and Google Meet— a communication tool (by 39.13%). The total numbers are, however, rather low, so one could doubt the result if not for the same increasement in other communication tools as e.g. Zoom (26.11%), WhatsApp (29.63%), or Messenger (23.88%). Table 2 shows the comparison of raw frequency of other educational technology software.

TABLE 2. Frequency of educational technology software usage.

NAME	AB	A	B	% B/AB	NAME	AB	A	B	% B/A
Kahoot	307	288	19	6.19	Ted ED/Talks	77	70	7	9.09
Grammarly	229	206	23	10.04	Quizziz	76	70	6	7.89
Edmodo	226	209	17	7.52	Messenger	67	51	16	23.88
Zoom	203	150	53	26.11	Padlet	51	42	9	17.65
YouTube	215	191	24	11.16	Moodle	34	28	6	17.65
Facebook	183	168	15	8.20	Canvas	31	28	3	9.68
MS Teams	119	108	11	9.24	Socrative	26	24	2	7.69
YouGlish	94	88	6	6.38	Udemy	25	25	0	0.00
PowerPoint	84	57	27	32.14	Lingro	22	21	1	4.55
WhatsApp	81	57	24	29.63	Flipgrid	20	15	5	25.00
Quizlet	77	68	9	11.69					

The results can be read as the higher the proportion percentage of B in AB, the bigger increasement of the educational technology software usage in the pandemic times.

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Looking closely at the function of the above listed most frequently mentioned educational technology software, altogether seven categories of function were created and researched within the study: academic tools, audio/visual making tools, communication tools, gamification tools, presentation tools, realia, plus the extra category of TEFL (Teaching English as a Foreign Language) materials, for more see Appendix.

TABLE 3. Educational technology software function – usage development.

	% AB	% A	% B	% B/AB	% B/A
academic	9.52	9.09	8.23	-1.30	-0.87
audio/visual	0.00	0.00	0.00	0.00	0.00
communication	45.45	44.59	46.32	-4.76	0.87
gamification	20.78	22.51	21.21	0.43	-1.30
presentation	5.63	4.33	8.66	8.66	3.03
realia	7.79	7.79	8.23	0.43	0.43
TEFL	10.82	11.69	7.36	-3.46	-4.33

Table 3 shows that regardless of the usage in and out of the pandemic times, educational technology software mentioned by the respondents fulfil mostly communication functions, followed by gamification functions. Decrease in usage due to the pandemic is notable only for TEFL sources, increase on the other hand in communication tools and in presentation tools.

Concerning educational technology hardware solutions, the majority of respondents connected educational technologies to online mode and web-based solutions (59%) or the tools usable both online and offline (39%; as e.g. apps/applications, videos, audios/sound), only 2% spoke explicitly about offline solutions (with code-words like face-to-face/face to face, normal classroom, etc.).

4. DISCUSSION

All the results need to be understood within the context of the COVID-19 pandemic and subsequent restrictions in social contacts leading to the shift into the virtual world along with the redefinition of educational technology towards this "new normal".

4.1.Q1 What educational technology was used in the pandemic times and what was the frequency of their usage?

The research data suggest that in the pandemic times the term educational technology became associated only with online applications or websites as opposed to the pre-pandemic definitions of educational technology, i.e. "the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (Januszewski, & Molenda, 2008, p. 1) or "in the nineteenth century […] educational toys and other learning tactics […]; in 1930-40 […] special types of scrambled books, cards and boards […]; 1960 […] industrial revolution […] progressing in the field of educational technology […]; now […] technological inventions like radio, tape-recorder, television, computer, CCTV i.e. closed circuit T.V., electronic video tapes and other audio-visual aids" (Sharma, 2002, p. 20).

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The shift in educational technology perception was caused by "emergency remote teaching" (for more see e.g. Iglesias-Pradas *et al.*, 2021) meaning that during the pandemic, emphasis was placed on remote/distance learning strategies that solved the sudden and panicked rush towards technology by teachers who had previously had no/low interest in it.

4.1.1. Educational technology - hardware

The research has shown a slightly higher frequency of entries on portable devices. If entries for phone (phone, smartphone, cell phone mobile and mobile device) are counted together, this type of hardware accounts for 49% of all listed delivery modes/educational technology hardware solutions. By adding results for a tablet/laptop/notebook (at 2%), all portable devices are mentioned in an educational context in 51% of cases as compared to non-portable devices, such a computer, a lab (meaning IT/English language/language, EFL/ESL lab), a computer lab (46%) plus a TV (1%) and a projector (2%), which makes 49% in total.

4.1.2. Educational technology – software

The top ten entry frequency list of educational technology software usage regardless of the pandemic (G-Suite not included), see Table 2, column A: Kahoot, Grammarly, Edmodo, YouTube Facebook Zoom, Microsoft/MS Teams, YouGlish, Quizziz, Quizlet. The top ten entry frequency list of educational technology software usage 'connected to/introduced by/caused by' the pandemic (G-Suite not included), on the other hand, is column B, Table 2: Zoom, PowerPoint /ppt, YouTube, WhatsApp, Grammarly, Kahoot, Edmodo, Messenger, Facebook, Microsoft/MS Teams.

As said above (see Results) the lists indicate that the shift to online learning affected primarily increasing numbers of communication platforms, rather than educational tools as such, for more see Table 3. Summing up the findings in words one of the respondents:

> When Covid 19 arrived, teachers wanted tools for communication more than anything else. They didn't really want to teach in new ways - they wanted tools to allow them to teach in the same way they already had been teaching. This suggests (to me) that post covid, most teachers will just go back to normal, and the way they teach their classes will be very similar to pre-covid. So, unless there is some kind of training or awareness-raising, most/all of the tools discovered during Covid will be abandoned as teachers go back to the old ways.

4.2. Q2 What function did educational technology listed in answer to Q1 serve?

4.2.1. Academic tools

The first category of 'academic tools' includes all those that one can use while studying or working on an academic task. Via these tools one can share knowledge, refer to/cite someone else's knowledge, develop interest in learning, innovate their learning strategies, enhance learning outcome, do research and many other functions/tasks. The most frequently mentioned citation manager was Zotero. The clouds, i.e. storing managers listed were e.g Dropbox, GoogleDrive. Another tool mentioned for academic purposes were dictionaries, e.g. Cambridge dictionary. For brainstorming and organizing thoughts, mind mapping software solutions were dis-

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cussed among the respondents, such as Mindmeister, or Mindmono. Into the category of academic tools one can put note-taking tools with the following (educational) technology software solutions, e.g. Smart notes.

If one wants to develop their writing skills the online writing labs: Writable can come handy as well as spell checkers: Grammarly, Writefull, et.c and/or thesauri plus corpus linguistics tools, e.g. SkEll or Thesaurus.com. Specifically, for researching survey makers can be utilized like: Survio or SurveyMonkey. Instructional mode changers can also be categorised within academic tools such as e.g. webinar software.

4.2.2. Audio/visual making tools

The second category of 'audio/visual making tools' are all those (educational) technology software solutions that one can use to create, to edit or to adapt audio or visual materials for personal teaching purposes. The first subcategory is all the software that can be used for animations and video creation/editing, e.g. Camtasia, Vyond. To create visually attractive teaching material or to edit someone else's (if copyright allows), graphic designing software such as Meme Creators, Pixton, or ScrapBook, can be used. The tool that could have been put under the heading academic tools (as e.g. live lecture can be streamed but also recorded) is screencast software, e.g. Quiztime or UltraScreen Recorder. The reason for the screencast software being categorised under audio/visual making tools is that it captivates images/videos for later use and these can serve as a great audio/visual teaching material. The fun element can be easily added to one's teaching material when teachers use speaking characters/avatars creators: Voki or video making/editing software like Powtoon. Another tool that can be put into more categories are website creators: blogger.com, or simeplesite.com. The websites communicate their content but this communication is mainly audio-visual and therefore can be seen as audio-visual making/editing tool too.

4.2.3. Communication tools

The third category are communication tools. These are all those (educational) technology solutions that enable to have social contact both synchronous and asynchronous. Communication tools can function without interaction, i.e. as a one-way channel, with semi-interaction (two-way channel but with no interaction to a certain time point), as well as with interaction (two-way channel with simultaneous interaction). The functions are principally calling/messaging, e.g. Microsoft Teams, Skype, WhatsApp, or Zoom, and enhancing cooperation as in collaborating educational platforms: EDMODO, or SkillShare. Instruction delivery tools like Coursera, Khan Academy, MOOC, Openuniversity, etc. or learning management systems: Canvas, MOODLE, or Udemy fall into the communication tools category too. The same applies to learning applications like e.g. Duolingo, or Hello English.

4.2.4. Gamification tools

The next category are gamification tools. These tools add an element of gaming into the classroom. One can create quizzes or tasks in many different formats. One subcategory is gamification software: Flipgrid, Kahoot, Padlet, Quizlet, or Quizzis, etc., i.e. those tools that allow the teachers to create/edit games/quizzes and similar activities. The other subcategory is that type of software that generate tests or serve as a testing source: Testmoz, Zipgrade.

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4.2.5. Presentation tools

The fifth category are presentation tools. These tools generally allow people to share their knowledge, ideas, images, texts and so on. These presentations can serve professional as well as entertainment purposes. The presentation tools by the respondents were: e.g. Microsoft Sway, Power Point, Prezi, or SlideShare. As the presentation can be seen also as a phase in the classroom procedure one can put also e.g. online whiteboards into the category of presentation tools like aww.com or Jamboard.

4.2.6. Realia

The sixth category contains sources were realia can be found. Realia are invaluable for learning and one can use e.g. sounds/music/lyrics such as LyricsTraining, Soundhound, The Hat, or (royalty free) pictures: Canva, Pinterest, Pixabay, or Shutterstock. To promote intercultural understanding, tolerance and (critical) reading literature is a great choice which could be the reason why respondents mentioned (free) e-books: Bookscool.com or Scribd, and (free) audio e-books, e.g. Librivox.org. For creativity enhancement, fun fiction writing activities, self-assessment portfolio creation and many other functions respondents discussed the possibility to use book creators: Book Creators and Kotobee Author. Special position among the realia are real videos e.g. on YouTube.

4.2.7. TEFL (Teaching English as a Foreign Language) materials

Because the author is personally interested in English as a foreign language teaching, an extra category was created from the respondents' most mentioned educational tools for learning/teaching English. These can be subcategorised into listening sources: ESL lab, or TED Talks/TED ed; reading sources: breakingsnewsenglish.com, fanfiction.net, or newsinlevels.com, and pronunciation sources, e.g. YouGlish.

A comprehensive collection of English language skills and knowledge development resources can be found e.g. in AE (American English), British Council, BusyTeacher, ESLcollective, Fluentu, etc. with some sources interactive, e.g. Edpuzzle, Liveworksheets.com, Nearpod, or Wordwall.

Nevertheless, the main finding from the qualitative analysis of educational technology function is that there is a large number of solutions one can use. One can choose what suits them best as the tools differ in style, design, options, etc. and can fulfil the same or similar function.

5. CONCLUSIONS

5.1. Limitations and future lines of research

There are several limitations to the research.

Firstly, the respondents were not specifically selected, i.e. do not represent any specific group and no detailed data is known about the respondents, nor their gender, age, region, or teaching experience. The participation on the research was a result of their online fora discussion contribution.

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Secondly the pandemic-related subset was created on the basis of code words. The code words were pre-defined as the most distinctive but for sure some other features could have distinguished the entry as 'due to/during the pandemic'.

Third limitation is caused by the fact that entries were not edited manually and therefore misspelled occurrences were not counted, i.e. WatsApp, WhatApp, and similar 'representations' of WhatsApp were not considered in the analysis.

Future lines of research can be:

1. Has the pandemics 'helped' digitally less/not equipped areas to support further growth in digital access and digital literacy, especially with using synchronous tools and their all possible functions? As it seems that digital access is still restricted to wealthier and younger and digital literacy is not further promoted once 'the need to work online is not present' globally anymore.

2. Do the changes in educational technology usage last when the pandemics is 'over'? As the education tend to 'forget everything connected to the pandemics' and have gone back to the face-to-face mode without using the acquired knowledge and skills regarding the educational technology.

5.2. Integration into the current literature

The study results complement previous research on educational tools. The text offers an updated and by-vast-data-analysis-justified list of educational technology tools to be used similarly to the lists in e.g. Onyema *et al*. (2021). Alongside with Abisado (2020), the text studies the change in educational technology function due to the COVID-19 pandemic.

5.3. Implications for theory and praxis

A similar situation in education happened in 2003 in Asia with the outbreak of SARS. Fung and Ledesma (2005, p. 1) summed up the change in education as "extending classroom [using] an interactive, real-time platform using web-technology in the delivery of teaching and learning" (see also Tatnall *et al.*, 2005). In Europe, the COVID-19 pandemic brought the same change but instead of (re)discovering what Asia had already found out, many first panicked. Even if not taking inspirations from SARS pandemics experience, educators had already many options at hand, e.g. flipped classrooms, defined as "with the help of the technology exchanged roles of teachers and students so that what teachers could do in class, (such as the theory explanation) it was done at students' homes." (Galindo-Domínguez, & Bezanilla, 2019, p. 82) or blended or hybrid learning modes. But technologies (including educational technology) started to be used only later, at first asynchronously and subsequently synchronously. Interaction and communication gained in significance in distance learning during the pandemic because no face-to-face contact was possible or there were severe restrictions.

The implication for the future is that "network-based communication" and "virtual communities" (for more see e.g. in Arnó Macià *et al*., 2020) need to be created and used to cross distances between people and to support the human need for dialogue within distance learning similarly to contact education. In contrast to the "Netspeak [talking online] that lacks facial expressions, gestures and conventions that are

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important in communicating face to face" (Salmon, 2002, p. 223), such technology is to be used that enables 'real-life-like' contact, e.g. Google Meet, Zoom, Microsoft Teams, Discort, Skype, Adobe connect or collaborative tools e.g. Google Slide + PearDeck, Nearpod, Google Docs. Chiappe *et al*. (2020) talk about the need to foster "educommunication in digital environments" warning however that "different digital environments involve different ways of conceiving and deploying interaction processes, inside and outside the classroom" (Chiappe *et al*., 2020, p. 34).

The subsequent suggestion might sound too obvious but a key enabling factor for synchronous distance learning is internet connection with camera on, only thus can the benefits of "original" distance learning and with the additional benefits of face-to-face learning be maintained, i.e. that "learning 'with' and learning 'from' [media and technology] increases performance […] enriches the maintenance of educational process, raises motivation of pupils to learn the English language and at the same time close cooperation between teacher and pupils is achieved." (Bagapova *et al*., 2020, p. 206), because blended learning offers this possibility to intertwine the above-mentioned benefits, as Morán (2012) emphasizes "b-learning combines face-to-face learning and distance learning in such a way that the best strategies of each modality are integrated and complemented to provide more flexible and solid learning experiences." (Morán, 2012, in Chiappe *et al*., 2020, p. 36)

With (new) web-based technology, (new) competences are to be enhanced among teachers and students or pupils. These (new) competences are, e.g. in Biletska, *et al*. (2021, p. 19): "literacy, quantitative thinking, inter/intrapersonal skills, civic awareness, professional skills, 21st-century skills that include cooperation, critical thinking, communication or problem solving, research skills, digital literacy, creative skills" but also "a set of skills that cannot be standardised. However, they are useful in atypical educational situations, the solution of which requires creativity, spontaneity, self-confidence, openness to new things, power to adjust" (Biletska, *et al*., 2021, p. 23). Developing digital literacy is discussed in numerous studies, in the pre-pandemic times, e.g. Padilla-Hernández *et al*. (2019) or in the 'post-pandemic' times, e.g. González-Rodríguez *et al*. (2022) or Gabarda *et al*. (2022) and educators can review these and act upon.

The last suggestion is to choose from the great variety of educational technologies, especially web-based technologies, those that suit the teacher best and use these to the fullest potential not only in times of pandemic, but also in the 'normal' face-to-face operation delivery.

5.4. Summary

Distance learning has gone through many changes caused by the COVID-19 pandemic with restrictions in social contacts and rapid transfer to the virtual world. Technology has helped education to continue despite the loss of physicality and educational technology, especially the web-based software solutions, enabled to reach, keep or even improve the quality of teaching and learning.

Educational technology moved mainly to portable devices and the term was understood by the respondents as virtual online tools more than in its original sense. In comparison to the past, in which mostly asynchronous distance learning tools were used, the pandemic increased the usage of collaborative, communicative, interactive synchronous tools. In addition to non-communicative ways (no interaction involved) and semi-communicative (no real time interaction involved or possible), communicative distance learning (real

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time interaction allowed) became very popular. Non-communicative delivery was organised via sending students homework, setting individual assignments via e-mail, mail or LMS=Learning Management System, and prompting autonomous learning. No or low possibility of social contacts meant that tools used normally in the classrooms needed to be adapted, for example, adding interactivity to textbooks. Teachers 're-discovered' that e.g. writing blogs, creating vlogs or finding a pen friend could serve their teaching purposes very well. These tools offered teachers at least semi-communication, asynchronous interaction between the communication partners. The same applies to chats, fora, discussion panels or LMS like Moodle and Canvas.

Google company products largely dominated in the preferences. The reasons were not researched but would be very interesting (at least for the Microsoft company), but generally most frequently used educational technology software solutions were online collaborative tools (mostly Google Docs, Google Forms) and communicative tools (mostly Google Classroom, Google Meet, Zoom, WhatsApp, Facebook, Messenger, and Microsoft/MS Teams), followed by gamification tools (most frequently Kahoot, Quizziz and Quizlet), presentation tools (PowerPoint), academic tools (Grammarly), e-learning (Edmodo), realia (YouTube). Communication tools and presentation tools together with realia underwent also the biggest increase in the usage during the pandemic times.

The pandemic also increased the variety of educational software solutions. For the same or similar function, more tools are now available, e.g. for online whiteboard respondents mentioned eight different platforms or for games twenty-one webpages that one can use. If for any reason the given tool is not suitable, there are or soon will be other options at hand and the teaching community worldwide is sharing, caring and helpful.

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7. APPENDIX

TABLE 3. Educational technology software function – usage development.

EDUCATIONAL TECHNOLOGY SOFTWARE FUNCTION – COMPLETE LIST	
FUNCTION	**NAME**
academic tools	
citation managers	Zotero
clouds	Box, Dropbox, EdWordle, GoogleDrive, MoodleCloud, Smart word
cloud, Symbaloo, Wakelet	
dictionaries	Cambridge dictionary, Collins dictionary, Longman dictionary,
Macmillan, MerriamWebster, Oxford dictionary, wikidiff.com	
mind maps	Mindmeister, mindmono, SpiderScribe
note taking	Evernote, Microsoft OneNote, Smart notes
online writing labs	Purdue OWL, storybird, Writable
spell checker	Grammarly, Hemingway editor, Writefull
survey makers	Likert, MOOCS, Nvivo, pollseverywhere.com, Polly, Survio,
SurveyMonkey	
thesauri/corpus linguistics	BNC, COCA/COHA, Lingee, Lingro, SkEll, Sketchengine,
Thesaurus.com, WordReference.com	
webinar software	Adobe connect

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audio/visual aid making tools	
video creation/editing	Camtasia, Vyond
graphic designing software	Meme Creators, Mozaik 3D, Pixton, piktochart, PosterMyWall,
ScrapBook, smore, ThingLink	
screencast software	Ocam Screen recorder, Recorder, Screen, Quiztime, UltraScreen
speaking characters/avatars	voki
video making/editing	Filmora, moviemaker, Powtoon
website creators	blogger.com, simplesite.com, Tumblr, Wix, Wordpress
communication tools	
calling/messaging	Blue Button, ClassDojo, DepEd, Discord, Doodle, Facebook
Messenger/Lite, Google Meet, GoToWebinar, Hangouts, Microsoft Teams, PearDeck,	
Schoology, Skype, Slack, Slido, Typeform, Vocaroo, VoiceThread, Webex, WeChat, WhatsApp, Whereby, Zoom	
"e-learning"	EDMODO, Google Classroom, PBworks, SkillShare, WIKI, WizIQ,
distance learning	Cake, Coursera, Engvid, FutureLearn, GOC, Khan Academy, MOOC, Openuniversity, Wakelet
online courses	Canvas, Gnomio, Iscollective, MOODLE, MyELT, Quipper School, Socrative, Udemy
learning applications	Agendaweb, Berlitz, Bus, Duolingo, Educreations, Elsa, Genyo, Hello English, Lingualift, Memrise, TOP 20 English
gamification tools	
gamification software	Baamboozle, Educaplay, Flipgrid, ChatterPix, Minecraft Edu
(Office 365), Padlet, Triventy, VocabularySpellingCity, Wordwall	
games/quizzes, tests	Battletex, BookWidgets, Crossword Puzzle, Freerice, Hot potato,
iCivics, iSpring, Kahoot, Kyon, learningapps.org, MindSnacks, Playbuzz, Plickers cards, Quizalize, Quizlet, QuizStar, Quizzis, studystack.com, Topquiz, Wondershare QuizCreator	
testing sources	Testmoz, Zipgrade
presentation tools	Blendspace, Mentimeter, Microsoft Sway, PearDeck, Photopeach, Piktochart, Power Point, Prezi, SlideShare
online whiteboards	aww.com, Blackboard, ExplainEverything, jamboard, Miro,
Smartdraw, Starboard, stormboard	
realia	
sounds/music/lyrics	LyricsTraining, Soundhoud, The Hat
royalty free pictures	canva, pinterest, pixabay, shutterstock
(free) e-books	bookscool.com, Freebooks, Project Gutenberg, Scribd, Vooks, Wattpad
(free) audio	e-books/book creators Aralinks ebooks, Book Creator, Kotobee
Author, librivox.org	
free video	YouTube

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TEFL (Teaching English as a Foreign Language) materials	
listening sources	ELLLO, ESL lab, Manythings.org, TED Talks/TED ed
reading sources	BBC Learning English, breakingsnewsenglish.com, Fandom,
fanfiction.net, newsinlevels.com, readable.com, Reading A-Z, ReadTheory, storylineonline.net, The Guardian, Voice of America (VOA)	
pronunciation	Balabolka, dragonVoice, soundcomparisons.com, VoiceOver,
YouGlish	
ESL resources	AE (American English), British Council, BusyTeacher, Englishwsheets, ESLcollective, Twinkl, Viwe Worksheets, VoA (Voice of America)
ESL resources live	edpuzzle, English banana, Liveworksheets.com, Nearpod, Wordwall