Trends and Topics in Educational Technology, 2022 Edition

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This editorial continues our annual effort to identify and catalog trends and popular topics in the field of educational technology. Continuing our approach from previous years (Kimmons, 2020; Kimmons et al., 2021), we use public internet data mining methods (Kimmons & Veletsianos, 2018) to extract and analyze data from three large data sources: the Scopus research article database, the Twitter #edtech affinity group, and school and school district Facebook pages. Such data sources can provide valuable insights into what is happening and what is of interest in the field as educators, researchers, and students grapple with crises and the rapidly evolving uses of educational technologies (e.g., Kimmons et al., 2020; Trust et al., 2020; Veletsianos & Kimmons, 2020). Through this analysis, we provide a brief snapshot of what the educational technology field looked like in 2021 via each of these lenses and attempt to triangulate an overall state of our field and vision for what may be coming next.

What Were Trending Topics in Educational Technology Journals in 2021?

Educational technology research topics for 2021 were very similar to previous years, with a few exceptions. In total, we collected titles for 2368 articles via Scopus published in top educational technology journals as identified by Google Scholar. We then analyzed keyword and bigram (two words found together) frequencies in titles to determine the most commonly referenced terms. To assist in making sense of results, we also manually grouped together keywords and bigrams into four information types: contexts, methods,

modalities, and topics. *Contexts* included terms referring to the research setting, such as “COVID-19” or “higher education.” *Methods* included terms referring to research methods involved in the article, such as “systematic review” or “meta-analysis.” *Modalities* included terms referring to the technical modality through which the study was occurring, such as “virtual reality” or “online learning.” Last, *Topics* included terms referring to the intervention, objective, or theoretical goal of the study, such as “computational thinking,” “learning environment,” or “language learning.” The most common bigrams and keywords for each type may be found in Table 1; a few items of interest follow.

Bigrams generally provide more specificity for interpreting meaning than do keywords, simply because keywords might have greater variety in usage (e.g., “school” might be used in the context of “primary school,” “secondary school,” “school teacher,” and so forth). So, when interpreting Table 1, the bigram column is generally more useful for identifying trending topics, though the keyword column may at times be helpful as a clarifying supplement.

“Computational thinking” and “learning environments” were the two most-researched topical bigrams in 2021, and “virtual reality” and “online learning” were the most-researched modality bigrams. Most-referenced methods included “systematic review” and “meta-analysis,” which is noteworthy because such methods are used to conduct secondary analyses on existing studies, and their dominance may suggest an interest in the field to identify what works and to synthesize findings across various contexts within a sea of articles that is ever-increasing in size.

Due to the ongoing COVID-19 pandemic, this contextual term was regularly mentioned in many article titles (5.4%). “Pandemic” (3.4%), “emergency” (1.2%), and “shift to” (e.g., digital, online, blended; 0.9%) were also commonly referenced. This suggests that as the world continues to grapple with this multifaceted crisis, educational technology researchers are heavily engaged in addressing educational concerns associated with it (and remote teaching, particularly).

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Table 1 Most Popular Educational Technology Title Bigrams and Keywords by Type

Bigram	<i>n</i>	%	Keyword	<i>n</i>	%
Contexts					
covid+19	128	5.4%	school*	140	5.9%
high* + education*	83	3.5%	high*	130	5.5%
university+student*	45	1.9%	covid-19	128	5.4%
school* + student*	40	1.7%	classroom*	97	4.1%
k + 12	40	1.7%	university	83	3.5%
pre + service	31	1.3%	pandemic	79	3.4%
high* + school*	26	1.1%	academic*	78	3.3%
primary+school*	24	1.0%	course	76	3.2%
secondary+school*	19	0.8%	writ*	59	2.5%
Methods					
systematic+review*	50	2.1%	design*	187	7.9%
meta+analysis	36	1.5%	study*	161	6.8%
evaluation+of	28	1.2%	review*	144	6.1%
literature+review*	26	1.1%	self	114	4.8%
influence+of	24	1.0%	perception*	81	3.4%
case+study*	24	1.0%	assessment*	78	3.3%
Modalities					
virtual+reality	71	3.0%	online	305	12.9%
online+learn*	69	2.9%	virtual	135	5.7%
augment* + reality	33	1.4%	mobile	109	4.6%
blended+learn*	33	1.4%	video*	66	2.8%
mobile+learn*	26	1.1%	blended	57	2.4%
shift* + to	21	0.9%	elearn*	52	2.2%
distance+learn*	21	0.9%	flipped	50	2.1%
flipped+learn*	19	0.8%	remote	45	1.9%
online+courses	19	0.8%	augment*	45	1.9%
flipped+classroom*	19	0.8%	distance	40	1.7%
Topics					
computational+think*	59	2.5%	environment*	133	5.6%
learn* + environment*	54	2.3%	model*	133	5.6%
game+based	43	1.8%	system*	130	5.5%
language+learn*	36	1.5%	performance	123	5.2%
self+efficacy	33	1.4%	reality	121	5.1%
social+media	31	1.3%	language	109	4.6%
student* + engagement	26	1.1%	social	102	4.3%
student* + perception*	26	1.1%	think*	97	4.1%
foreign+language	26	1.1%	game	97	4.1%
education* + technology	26	1.1%	engagement	95	4.0%
learn* + analytic*	24	1.0%	comput*	92	3.9%
cognitive+load	21	0.9%	skill*	90	3.8%
artificial+intelligence	21	0.9%	collaborative	85	3.6%
learn* + analytics	21	0.9%	instruction*	83	3.5%
self+regulat*	21	0.9%	motivation*	69	2.9%
learn* + outcomes	21	0.9%	knowledge	69	2.9%

Grade level references in titles further suggested that educational technology research is being conducted at all levels but that it is most prominent at the higher education or post-secondary level and reduces in frequency as grade levels go down, with high school or secondary terms being more prominent than elementary or primary terms, with “higher education” (3.5%) being referenced twice as frequently as “K-12” (1.7%). This is noteworthy as it suggests that research findings associated with educational technology are currently mainly focused on older (and even adult) students and that if results are applied to understanding learners generally, then the needs of adolescents and younger children may currently be relatively underrepresented.

What Were Trending #Edtech Topics and Tools on Twitter in 2021?

Twitter is a valuable source of information about trends in a field because it allows researchers and practitioners to share relevant resources, studies, and musings and categorize posts via descriptive hashtags. The #edtech hashtag continued to be very popular during 2021, and we collected all original tweets (ignoring retweets) that included the #edtech hashtag for the year. This included 433,078 original tweets posted by 40,767 users, averaging 36,090 tweets per month ($SD = 2974$).

Because users can include multiple hashtags on a tweet, we aggregated the frequencies of additional (co-occurring) hashtags to determine the intended audiences (e.g., #teachers, #k12) and content topics (e.g., #elearning, #ai) of tweets. Some of the most popular additional hashtags of each type are presented in Table 2. To better understand results, we also calculated the representation of each additional hashtag in the overall dataset (e.g., 2% of all #edtech tweets also included the #teachers hashtag) and the diversity of authorship (i.e., the number of users divided by the number of tweets). This diversity score was helpful for understanding how some hashtags were used by relatively few accounts for purposes such as product promotion. For example, the #byjus hashtag, which refers to an educational technology company founded in India, was tweeted 19,546 times. Still, the diversity score was only 3%, revealing that though this was a very popular hashtag in terms of tweet counts, it was being included by relatively few accounts at very high frequencies, such as via focused marketing campaigns.

Notably, several community or affinity space hashtags (Carpenter & Krutka, 2014; Rosenberg et al., 2016) were among the most common included with #edtech, such as #edchat, #edutwitter, and #teachertwitter. In particular, 13.9% of #edtech tweets also were tagged as #educhat, and 25.7% of #educhat tweets were also tagged as #edtech, revealing relatively high synchronicity between these two

Table 2 Most Popular Additional Hashtags in #edtech Tweets by Type

Hashtag	Users	Tweets	Representation	Diversity
Audience, Community, or Affinity Space				
edchat	3600	60,252	14%	6%
edutwitter	2249	14,669	3%	15%
teachers	2206	10,155	2%	22%
edtechchat	1856	17,922	4%	10%
students	1818	8025	2%	23%
highered	1770	14,013	3%	13%
k12	1712	25,500	6%	7%
school	1284	9419	2%	14%
highereducation	1161	4715	1%	25%
teacher	1034	4824	1%	21%
teachertwitter	1026	6861	2%	15%
schools	995	5578	1%	18%
educators	850	3440	1%	25%
Topic				
education	9374	93,459	22%	10%
learning	3896	25,909	6%	15%
elearning	2875	27,816	6%	10%
onlinelearning	2681	12,423	3%	22%
technology	2577	10,826	2%	24%
remotelearning	2380	10,732	2%	22%
ai	2112	11,323	3%	19%
stem	1913	15,760	4%	12%
teaching	1869	15,146	3%	12%
innovation	1705	6915	2%	25%
startup	1690	6950	2%	24%
tech	1537	7139	2%	22%
startups	1393	3730	1%	37%
coding	1032	4252	1%	24%
distancelearning	1022	5601	1%	18%
vr	917	4368	1%	21%
covid19	906	3831	1%	24%
fintech	895	3335	1%	27%
virtuallearning	872	2769	1%	31%
digitaltransformation	851	3215	1%	26%
digitallearning	841	4021	1%	21%
cybersecurity	820	3111	1%	26%
blendedlearning	781	4268	1%	18%

spaces. Furthermore, regarding institutional level, #k12 ($n = 1712$) and #highered ($n = 1770$) exhibited similar user counts, as did #school ($n = 1284$) and #highereducation ($n = 1161$), but, interestingly, the #k12 and #school hashtags exhibited nearly twice as many tweets as their #highered and #highereducation counterparts. This suggests that although the communities tweeting about topics for each group may be of similar size, the K-12 community was much more active than the higher education community.

Regarding topics, #elearning, #onlinelearning, #remotelearning, #distancelearning, #virtuallearning, and #blendedlearning were represented at a relatively high rate (in 16.1% of tweets), perhaps reflecting ongoing interest associated with #covid19. Other prominent topical hashtags included emerging technologies, such as #ai ($n = 2112$), #vr ($n = 917$), #ar ($n = 679$), and #blockchain ($n = 545$), as well as subject areas (e.g., #stem) and general descriptors (e.g., #innovation).

Furthermore, one of the primary reasons for tweeting is to share resources or media items. An analysis of these #edtech tweets revealed that 94.4% included either a link to an external site or an embedded media resource, such as an image or video. Regarding external links, prominent domains included (a) news sites, such as [edsurge.com](https://www.edsurge.com), [edtechmagazine.com](https://www.edtechmagazine.com), or [edutopia.org](https://www.edutopia.org), (b) other social media, such as [linkedin.com](https://www.linkedin.com), [instagram.com](https://www.instagram.com), or [facebook.com](https://www.facebook.com), (c) multimedia resources, such as [youtube.com](https://www.youtube.com), anchor.fm, or podcasts.apple.com, and (d) productivity and management tools, such as docs.google.com, forms.gle, or [eventbrite.com](https://www.eventbrite.com) (cf., Table 3).

Twitter communications in 2021 regarding #edtech included chatter about a variety of topics and resources. Shadows of #COVID-19 might be detected in the prevalence of this hashtag with others, like #remotelearning and #onlinelearning, but in many ways it seems that conversations continued to focus on issues of #education and #learning, as well as emerging topics like #ai, #vr, and #cybersecurity, suggesting some level of imperviousness to the pandemic.

What Were Trending Topics among Schools and School Districts on Facebook in 2021?

To examine trending educational technology topics on Facebook, we studied the posts by 14,481 schools and school districts on their public pages. First, one aspect of this analysis concerned the number of posts shared. In our last report, we documented how schools and districts posted more posts than in any other month during March, April, and May 2020—during the earliest and perhaps most tumultuous months of the COVID-19 pandemic, suggesting the importance of communication during this crisis period, as others have documented with Twitter data (Michela et al., 2022). Notably, in 2021, those months remained the most active; apart from those months, the numbers of posts by schools and districts in 2021 were roughly comparable to the numbers in 2019 and 2020 (see Fig. 1).

To understand which technologies were shared on these Facebook pages, we examined the domain names for all of the hyperlinks that were posted. Despite the myriad social and other changes experienced by schools from 2019 to

Table 3 Most Common External Link Domains Referenced in #edtech Tweets

Domain	Users	Tweets
edsurge.com	2879	6588
youtube.com	2595	12,402
linkedin.com	475	1142
edtechmagazine.com	316	1463
instagram.com	302	511
edutopia.org	281	762
docs.google.com	276	681
techcrunch.com	270	646
forbes.com	251	473
facebook.com	170	338
forms.gle	159	248
medium.com	155	503
yourstory.com	155	1238
link.medium.com	149	268
edweek.org	140	438
eschoolnews.com	138	595
shakeuplearning.com	131	3344
eventbrite.com	130	232
edtechnology.co.uk	126	318
eventbrite.co.uk	126	532
anchor.fm	125	496
podcasts.apple.com	123	223
livemint.com	117	626
techlearning.com	116	332
sites.google.com	115	193
vmukta.com	114	546
economictimes.indiatimes.com	110	908
drive.google.com	108	196

Fig. 1 The Number of Posts on Facebook by Schools and School Districts

2021, link domains shared on Facebook exhibited remarkable consistency: Youtube, Google Docs, Google, and Google Drive—Google or tools created by Google—were the four most frequently shared for each of these years (Table 4). Note that the n represents the number of schools or districts sharing one or more links to these domains (of the 14,481 total school and school district pages). Thus, the 8278 indicates that 57.2% of schools and districts posted one or more links to YouTube over the 2021 year. These were followed by Zoom, which was also widely shared in 2020 (though not in 2019), and then Google Sites (which was shared frequently in 2020). The CDC and 2020 Census’s websites dropped from the list of the top ten most frequently shared domains in 2021, despite having been widely shared in 2020. Otherwise, the results are largely comparable between 2019, 2020, and 2021, indicating that schools and districts continued to use a core set of productivity tools despite the many disruptions and changes over this period.

We also examined the contents of the messages of schools’ and school districts’ posts. To do so, we considered the technologies identified by Weller (2020) in his history of the past 25 years of educational technology, as in our report for last year. Specifically, we searched the contents of the messages posted by schools and districts for the inclusion of the terms that correspond to technologies Weller identified as being representative of a particular year. While the domains shared by schools and districts demonstrated remarkable consistency, the contents of the messages posted by schools and districts varied substantially, especially when considering the changes from 2019 to 2020 and from 2020 to 2021. To illustrate, consider mentions of “e-learning,” which Weller identified as the focal point of 1999. In 2019, 834 messages that mentioned “e-learning” were posted by schools and districts, but in 2020, the number increased around ten-fold to 8326 mentions. Though it may have been expected for mentions of “e-learning” to remain somewhat constant during 2021, instead we saw a marked downturn to 1899 (or a 78% drop). This trend—a sizable increase in how often certain technologies were mentioned in 2020 relative to 2019 that was not sustained in 2021—was also found for mentions of “learning management systems,” “video,” and “Second Life and virtual worlds,” among others. Indeed, the only noteworthy increase in mentions of these technologies from 2020 to 2021 was for “artificial intelligence”.

Topic	2019	2020	2021	Total
1994: Bulletin Board Systems	0	0	0	2
1995: The Web	4953	12,269	8001	50,750
1996: Computer-Mediated Communication	0	0	0	1

Table 4 Domains for Hyperlinks Shared on School and School District Facebook Pages

2019		2020		2021	
Domain	<i>n</i>	Domain	<i>n</i>	Domain	<i>n</i>
youtube.com	5117	youtube.com	10,261	youtube.com	8278
docs.google.com	4557	docs.google.com	10,033	docs.google.com	7662
google.com	3198	google.com	9861	google.com	4969
drive.google.com	2082	drive.google.com	5616	drive.google.com	3688
surveymonkey.com	1513	zoom.us	4563	zoom.us	3198
signupgenius.com	1441	accounts.google.com	3718	accounts.google.com	2616
eventbrite.com	1299	sites.google.com	3469	sites.google.com	2043
bookfairs.scholastic.com	996	cdc.gov	2475	signupgenius.com	1529
vimeo.com	985	surveymonkey.com	2236	nfhsnetwork.com	1512
smore.com	890	bookfairs.scholastic.com	1817	smore.com	1508
sites.google.com	877	smore.com	1786	bookfairs.scholastic.com	1456
accounts.google.com	798	vimeo.com	1626	surveymonkey.com	1442
applitrack.com	634	2020census.gov	1455	gofan.co	1288
gofundme.com	452	signupgenius.com	1421	vimeo.com	1203
mailchi.mp	452	eventbrite.com	1225	eventbrite.com	1190

Topic	2019	2020	2021	Total
1997: Constructivism	1	3	0	25
1998: Wikis	515	736	584	4172
1999: E-Learning	834	8362	1899	13,136
2000: Learning Objects	81	77	76	471
2001: E-Learning Standards	0	0	0	0
2002: Learning Management Systems	79	719	221	1316
2003: Blogs	33,583	35,469	30,808	247,606
2004: Open Educational Resources	5	4	24	63
2005: Video	41,493	116,985	55,829	395,100
2006: Web 2.0	1	1	0	62
2007: Second Life and Virtual Worlds	32	301	122	564
2008: E-Portfolios	7	6	2	59
2009: Twitter and Social Media	9266	20,459	11,927	66,345
2010: Connectivism	0	0	0	0
2011: Personal Learning Environments	0	0	0	9
2012: Massive Open Online Courses	1	1	0	17
2013: Open Textbooks	4	1	0	6
2014: Learning Analytics	0	3	3	19
2015: Digital Badges	35	29	29	166
2016: Artificial Intelligence	119	98	127	511

Topic	2019	2020	2021	Total
2017: Blockchain	14	12	17	78
Total	2,774,756	3,199,999	2,705,678	18,330,356

Summary and Discussion

By triangulating the 2021 snapshots of each of these three data sources—Scopus, Twitter, and Facebook—we can begin to see a state of the educational technology field pressing into the future. Results on specific terms or topics may be useful for individual researchers and practitioners to see the representation of their areas of interest. Still, some common takeaways that emerge from all three sources include the following.

First, we found an emphasis on “e-learning”—particularly in Twitter and Facebook posts—as well as “blended learning” (Twitter) and “online learning” (journal articles). Notably, COVID-19 (and related terms) were also frequently mentioned. These findings align with how mentions of “e-learning” spiked during the 2020 year when the effects of the COVID-19 pandemic on education were especially disruptive, but their ongoing presence also suggests that interest in these topics will likely extend outside and beyond the context of the pandemic.

Second, we note a keen interest in emergent technologies like artificial intelligence and virtual reality, particularly on the part of researchers (as evidenced by how frequently these terms were mentioned in journal articles published in 2021). At the same time, we note that this interest has not yet crystallized into the sustained adoption and use of these

emergent technologies—a point bolstered by the relatively limited mention of these technologies in the Facebook posts of schools and school districts. Thus, we think we as a field must wait and see whether interest in these technologies is lasting or transient.

Last, we found an ever-increasing reliance on several corporate entities for productivity and sharing. This was especially the case for Google and tools created by Google: YouTube, Google Docs, and Google Drive, in particular. Indeed, such tools are such an established part of our work (and educational) context that we might hardly think of them as tools. Furthermore, tools created by Google and several other corporations—including social media platforms themselves—were also prevalent in the content of the tweets we analyzed. While we do not believe it is a bad decision on the part of individuals or educational institutions to use these and other tools, there are also some potential downsides to their use that we think invite critical questions (Burchfield et al., 2021; Krutka et al., 2021).

As a result of these common takeaways, we will now conclude with three questions for educational technology researchers and practitioners to consider.

Pandemic Bump Vs. Ubiquity

First, many have wondered whether changes in educational technology catalyzed by the pandemic will yield sustained, ubiquitous changes to the field, or if adjustments represent only a short-term bump of interest—as may be the case with emergency remote teaching tools and strategies used in the early days of the pandemic (Hodges et al., 2020). One of the takeaways from our Facebook analysis was that while some productivity technologies appeared to have remained consistently used on the basis of our domain analysis (e.g., Google Docs), mentions of many specific technologies in the messages of the posts by schools and districts appeared to have been more transitory in nature, such as in the cases of “e-learning” and “learning management systems.” This suggests at least two possible interpretations. One is that these technologies were used in transient response to an unprecedented period of emergency remote instruction—though tools associated with remote teaching and learning continue to be used, their use was primarily a temporary, emergency measure. Another is that these tools were mentioned less because they have become a more ubiquitous but less visible tool used by teachers and learners. Learning management systems may still, of course, be widely used, but schools and districts may be sharing about their role less through their public social media platforms because they may already be familiar to students and their parents. While we cannot say why there was a dramatic increase followed by a decrease in the use of many educational technologies over the period from 2019 through 2021, our analysis indicates that many

tools are, at least, being communicated about much less over the past year than in the preceding year when the pandemic began in the U.S.

Technocentrism Vs. Focusing on Learners and Improving Educational Systems

Second, though emerging technologies are obviously an essential component of our field, one of the perennial challenges we must grapple with is our relationship to these technologies. Are we technocentric, as Papert (1987, 1990) warned, or do we focus on learning and improvement? In our results, we notice that technologies such as artificial intelligence, virtual reality, and augmented reality were very frequently referenced in comparison to most other modalities or topics of research. As processing and graphical rendering capabilities continue to become more compact and inexpensive via headsets, smartphones, and haptic devices, we would expect these technologies to continue to receive ongoing attention. Though there are certainly valuable learning improvement opportunities associated with such technologies (Glaser & Schmidt, 2021), we might also justifiably wonder whether the volume of attention that these technologies are currently receiving in the literature is concomitant to their actual (or even hypothetical) large-scale learning benefits—or whether current fascination with such technologies represents a repeat of other historical emphases that may not have panned out in the form of systemic educational improvement, such as in the case of MUVes (cf., Nelson & Ketelhut, 2007).

Limited Broader Impacts on Larger Social Issues

Finally, to reiterate our critiques from previous years (Kimmons, 2020; Kimmons et al., 2021), we continued to see a dearth of references to important social issues in scholarly article titles, including references to social matters upon which educational technology should be expected to have a strong voice. For instance, terms relating to universal design ($n=0$), accessibility ($n=4$), privacy ($n=8$), ethics ($n=12$), security ($n=8$), equity ($n=6$), justice ($n=1$), and (digital and participatory) divides ($n=1$) were all very uncommon. Though “ethics” was the most common of these terms, it only was represented in 1-in-200 article titles, and though current “practices with student data represent cause for concern, as student behaviors are increasingly tracked, analyzed, and studied to draw conclusions about learning, attitudes, and future behaviors” (Kimmons, 2021, para. 2; cf., Rosenberg et al., 2021) and proctoring software becomes increasingly ubiquitous (Kimmons & Veletsianos, 2021), “privacy” was only mentioned in 1-in-333 article titles and “proctor*” was only in 1-in-600 titles. In our current pandemic context, we have often heard educational technologists lament the fact

that decision-makers and those in power may not seek our guidance in addressing issues related to the pandemic that would clearly benefit from our expertise. And yet, the absence of other socially-relevant topics from our research suggests that we may be challenged to leverage our work toward addressing matters of larger social or educational importance ourselves. A focus on the social matters and the social context around educational technology use, then, remains an opportunity for research and development by the educational technology community in the years ahead. This seems especially salient as our data suggests that the field is heavily influenced by big technology corporations like Google and Facebook that historically have been critiqued for violating ethical expectations of privacy and failing to support social good. As educational technology researchers and practitioners, we are primed with the position and expertise necessary to shape the future of ethical technology use in education. Hopefully, we can step up to this challenge.

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