Current Trends (and Missing Links) in Educational Technology Research and Practice

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Abstract

It has historically been difficult to find reliable, up-to-date information about educational technology trends, such as what researchers are studying and what tools practitioners are using, thereby making it difficult for researchers and practitioners to synergize their efforts in meaningful, socially-responsive ways. In this editorial, I analyze titles and abstracts of 7708 research articles from prominent journals over the past 5 years to identify common topics—such as “online,” “mobile,” and “learning analytics.” I also extract links from 51,496 K-12 school and 1317 university websites in the U.S. to identify common tools that they are linking to—such as Facebook, Twitter, Google Docs, and YouTube. I propose that these sorts of metrics provide a baseline understanding for other researchers and practitioners to draw upon when situating their work and that they can also give us insights into areas that merit greater attention for addressing real-world problems.

Keywords Trends · Bibliometrics · Web scraping · Big data · Research-practice divides · Educational technology

It is often difficult for educational technology professionals to find reliable data on current trends in the field. This can make it challenging for stakeholders, as (a) policymakers struggle to know what technologies are being used and researched, (b) practitioners struggle to know how they should adapt to changing needs and possibilities, and (c) researchers struggle to understand diffusion patterns of promising tools and how to use them to address meaningful problems.

In addition to this difficulty, in our field we often seem to struggle to understand and articulate how our work is valuable to society, lacking the ability to solve many real problems in real settings. For instance, though the COVID-19 pandemic recently influenced rapid shifts to remote and online learning—something that educational technology professionals are technically well-equipped to support—very real emergent concerns over equity, digital inclusion, privacy, and accessibility for students of all ages reveal that we as a field could be providing better leadership in the human aspect of learning—the “educational” aspect of “educational technology” (Goldstein 2020; Veletsianos and Kimmons 2020).

Many researchers have argued for decades that our field should be more situated and socially aware (Reeves et al. 2005), explaining that “there is a clear need for [us] ... to take stock of who we are, what it is we do, and how and why we do it,” paying greater attention “to how digital technologies are actually being used—for better and worse—in ‘real-world’ educational settings” (Selwyn 2010, pp. 65–66). Yet, digital divides persist in evolving forms (Dolan 2016), research and practice are often misaligned (Amiel and Reeves 2008), and even seemingly fundamental ethical and social considerations often remain conspicuously ignored (like addressing issues of discriminatory design [Benjamin 2019] or making school websites universally accessible for students [Kimmons and Smith 2019]).

In a recent study of 3 years of articles from a prominent educational technology journal, Mason (2018) found that “in a substantial portion of the discourse, there is a deep metaphor of technology as the agent or driver of social progress underlying the thinking of many authors” (p. 550), often implying that “technologies have their own autonomy and agency” (p. 545). Yet, technologies rather seem to merely exacerbate many of the deep problems we face as groups, because “the societies in which technologies are introduced are not neutral, [and] if a society or school is racist, sexist, or ableist, supposedly neutral technologies can amplify those bigotries” (Krutka et al. 2020, p. 112).

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To be clear, there are leaders in the field who have sought to address these important issues for decades (e.g., Dickson-Deane et al. 2018; Marri 2005; Mehta and Aguilera 2020; Selwyn 2004; Sulecio de Alvarez and Dickson-Deane 2018; Tawfik et al. 2016; Tufekci 2014; Watters 2019), but our overall tone can remain highly technocentric and technophilic rather than learner-centric and humanizing, wherein “the nearly constant emergence of new technologies has only created the new problem of learning to use those [specific] technologies effectively [to] support learning” (Spector 2020, p. 834). Yet, as Spector (2020) recently argued: “We can do better as educators and educational technology researchers. We can forego the impulse to use a technology just because it is new ... [and] focus on helping students learn—all students ... not just the gifted or those we like or who like us or who are like us” (p. 835).

In this brief editorial, I will share some high-level results of two analyses—trending research topics among prominent educational technology research journals for the past 5 years and trending links from K-12 school and university websites in the U.S. in 2019—to show what is currently happening in educational technology, where there might be potential disconnects between research and practice, and how we might realign our emphases to better address pertinent real-world problems. These analyses rely wholly upon public data sources available through the internet (Kimmons and Veletsianos 2018), and though not exhaustive or representative of all contexts, they should at least provide some useful lenses for discerning what is happening (and perhaps what is missing) in educational technology.

Trending Research Topics

To understand the topics educational technology researchers have been studying over the past 5 years, I used the Elsevier Scopus (n.d.) API to collect all articles from the most-highly-cited journals in the field of educational technology as identified by Google Scholar (n.d.), which included *TechTrends*, *Computers & Education*, *Educational Technology Research & Development*, and 13 others. This produced 7708 articles with titles and abstracts. I then parsed each title and abstract into a list of keywords, removing stopwords (e.g., “a,” “and,” “the”), reducing words to their stems (e.g., “reading” and “reads” to “read,” “games” and “game-based” to “game”), and grouping words as positional pairs (e.g., “learning” and “environment” together for “learning environment”). Titles produced over 8500 unique keywords (e.g., “flipped,” “classroom”), while abstracts produced nearly 30,000. Reading top keywords and pairs for the current year, I excluded those that dealt with general aspects of the field (e.g., “technology,” “learning”), research methods (e.g., “case study”), participants (e.g., “teachers”), grade levels, and so forth, allowing the

analysis to focus on those that dealt with specific areas of study, topics, or technologies. Top results for article titles in the current year are provided in Table 1, and results from abstracts are provided in Table 2. In each table, raw numbers of articles that included the keyword or pair are provided from 5 years ago, while subsequent years are represented as percentage increases or decreases from each previous year to show relative adjustments over time.

We see from these title results that the modality “online” (e.g., “online learning,” “online teaching”) has clearly been the most-researched topic over the past 5 years, followed by the modality “mobile,” and accompanied by related modalities of “e-learning,” “blended,” and “distance.” The most-researched subject areas in this time period included “language” (including “EFL”), “science,” “writing,” “reading,” and “mathematics.” The most-researched applications of technologies or approaches have included “games,” “flipped,” “learning environment,” “video,” “MOOCs,” “media,” “virtual reality,” and “augmented reality,” with “data” and “learning analytics” also making the list.

When analyzing abstracts, only keyword pairs were considered, given the greater variability and volume of common words extracted from the lengthier artifacts (e.g., “student,” “education”), and keyword pairs representing generalities, research methods, participants, etc. were excluded to focus on areas of study, topics, and technologies. Again, modalities were highly represented (e.g., “online learning,” “online course,” “mobile learning,” “flipped classroom”) along with “language learning” and “foreign language” as the dominant subject areas and “social network,” “learning analytics,” and “social media” as the dominant technologies or applications.

Taken together, these title and abstract results suggest that researchers over the past 5 years (a) have focused heavily on studying learning environments as modalities (e.g., online, mobile, flipped), (b) have done so with the purpose of achieving learning goals related to language learning, science, writing, reading, and mathematics, and (c) have used various technologies toward these ends, with learning analytics, virtual reality, augmented reality, and social media being some of the most prominent (Figs 1 & 2.).

Trending Technologies from Institutional Websites

As another data source, I also parsed links from 51,496 U.S. K-12 school websites and 1317 U.S. college or university websites to attempt to determine what tools these institutions were linking to (and by extension using) with their students and communities. Because the number of unique links exhibited highly positive skew (with many sites providing very few external links), I excluded all sites below the median number of unique external links (median = 16 for K-12 schools). This

Table 1 Trending topics from research article titles as ranked by 2019 prevalence

Rank	Keyword or Pair	Paired examples	2015	2016	2017	2018	2019
1	Online	Online learning, online teaching	124	24%	−11%	3%	17%
2	Mobile	Mobile learning, mobile games	44	27%	−13%	41%	7%
3	Games	Game-based learning	60	10%	−6%	53%	−31%
4	Language	Languages	53	49%	20%	−28%	−9%
5	Flipped	Flipped classroom	7	43%	210%	29%	48%
6	Learning Environment	—	44	30%	0%	−33%	39%
7	English as a Foreign Language (EFL)	—	27	−7%	4%	−46%	193%
8	Science	—	53	−13%	24%	−28%	0%
9	Video	Video-based	15	27%	84%	−14%	33%
10	MOOC	—	32	−22%	24%	26%	3%
11	E-Learning	—	26	92%	−28%	−33%	63%
12	Writing	—	24	29%	29%	−33%	37%
13	Data	Data-driven, data-based	23	−17%	11%	−19%	76%
14	Blended	Blended learning	25	48%	−27%	−11%	25%
15	Learning Analytics	—	8	88%	−40%	167%	13%
16	Media	Media-based	24	29%	45%	−38%	−7%
17	Reading	—	16	63%	35%	−31%	4%
18	Virtual Reality	—	5	20%	−33%	250%	71%
19	Augmented Reality	—	4	275%	−20%	−25%	133%
20	Distance	Distance learning	20	−10%	−11%	19%	5%
21	Mathematics	—	29	21%	29%	−51%	−14%

resulted in the analysis of 954 K external links from K-12 sites, representing 25,889 websites, and 82 K external links from college and university sites, representing 10,682 websites.

Results indicated that the top sites that K-12 schools linked to included social media sites (e.g., Facebook, Twitter, Instagram, LinkedIn), media sharing sites (e.g., YouTube, Vimeo), a host of different Google tools (Docs, Sites, Drive, Translate, Mail), and various other tools that are designed to

support school business management and communication processes (e.g., SchoolMessenger, My School Bucks, PeachJar). These results mimicked other studies on school websites, which have generally shown that schools link to free, generic, non-pedagogical tools, like YouTube, much more than fee-based or education-specific tools, like SchoolTube (Kimmons 2015; Kimmons et al. 2019). College and university websites exhibited similar prioritization of links to social media, email, and image and video sharing services, coupled with a few types of services unique to that market (e.g., virtual campus tours).

Table 2 Trending topics from research article abstracts as ranked by 2019 prevalence

Rank	Keyword Pair	2015	2016	2017	2018	2019
1	Learning Environment	124	17%	−1%	−15%	24%
2	Online Learning	46	67%	−21%	−20%	65%
3	Online Course	65	2%	−15%	13%	17%
4	Learner Experience	46	17%	9%	−7%	24%
5	Language Learning	42	62%	−29%	−4%	30%
6	Foreign Language	52	12%	10%	−39%	51%
7	Mobile Learning	28	39%	−8%	0%	33%
8	Collaborative Learning	43	23%	−17%	−2%	7%
9	Social Network	39	8%	5%	−20%	23%
10	Learning Analytics	15	20%	−17%	127%	21%
11	Flipped Classroom	7	100%	79%	8%	48%
12	Social Media	24	108%	−24%	−26%	32%

Trends and Missing Links

Though web scraping of school websites is by no means a complete measure of school use and cannot capture most pedagogical and classroom uses, differences between what is being researched and what is being used by educational institutions to communicate and share with their communities should at least make us wonder whether trending research topics actually focus on what is happening in and is useful for our institutions. Google Docs/Drive, for instance, was only mentioned in 18 abstracts (0.2%), although it was represented on 25.9% of school websites, and Facebook and Twitter were mentioned in 132 (1.7%) and 61 (0.8%) abstracts while being

Fig. 1 Trending topics from research article titles as ranked by 2019 prevalence

represented on 56.7% and 55.3% of school websites (and most college and university websites). Research emphasis on social media overall decreased in 2017 and 2018 with a modest upturn in 2019, only exhibiting half the article count of “virtual reality,” one-third that of “MOOCs,” and one-fourth that of “flipped,” and though Google Docs and other tools might be studied in articles related to collaborative writing, peer feedback, or flipped classrooms, omission of these technologies from article abstracts should at least give us pause. Does this discrepancy reveal that research is not as needed on

these topics? Or that current research focuses on issues related to learning vs. specific tools? Or that a gap exists between research and practice, with researchers and journal reviewers exhibiting a technophilic flow toward the newest technologies (rather than those that are being used by institutions to solve pressing problems)?

To further explore this, we might also consider what keywords are missing from educational technology abstracts. Notably, keywords that deal with broader social issues (even those specific to educational technology) are generally

Table 3 Trending technologies from school website links

Resource	Category	Representation	Avg. links
Facebook	Social Networking	56.7%	1.5
Twitter	Microblogging	55.3%	1.6
Google Docs	Collaborative Authoring	25.9%	2.6
YouTube	Video Sharing	25.3%	1.3
Instagram	Image Sharing	23.2%	1.3
Google Sites	Website Hosting	23.1%	3.5
Google Drive	Document Sharing	20.0%	3.8
Google	Search	15.2%	5.4
SchoolMessenger	Notifications	10.0%	1.0
Google Translate	Automated Translation	8.6%	23.4
My School Bucks	Meal Payment	6.4%	1.1
LinkedIn	Social Networking	6.3%	1.2
PeachJar	Broadcast Communications	6.2%	1.1
Google Mail	Email	5.2%	1.1
School Nutrition and Fitness	Lunch Menus	5.0%	1.3
School Loop	Communications	4.6%	2.0
Aesop Online	Absence Management	4.5%	1.0
Board Docs	Document Sharing	4.2%	1.2
Vimeo	Video Sharing	3.8%	1.2

Fig. 2 Trending keyword pairs from research article abstracts as ranked by 2019 prevalence

missing over the past 5 years. The keyword “accessibility” was only included in 80 abstracts (1%); only 59 (0.8%) mentioned “women;” only 50 (0.6%) mentioned “privacy;” only 33 (0.4%) mentioned a “digital divide;” only 32 (0.4%) mentioned “justice;” only 27 (0.4%) mentioned “equity” or “equitable;” only 13 (0.2%) mentioned “poverty” or “impoverish;” only 9 (0.1%) mentioned “universal design;” only 8 (0.1%) mentioned “feminism” or “feminist;” only 7 (0.1%)

mentioned “racial;” and only 1 mentioned “racism” or “racist;” with only about 3% of articles mentioning any of these words. As a specific example, only 8 (2.2%) of the 368 articles studying “online learning” in the past 5 years mentioned the word “accessibility” or “accessible” in their abstracts, and none mentioned privacy, which seems like a major problem. If we are studying “how to make online learning work” but not “how to make it work for *all students*” or “how to protect our

Table 4 Trending technologies from college and university website links

Resource	Category	Representation ^a	Avg. Links
Twitter	Microblogging	—	1.5
Facebook	Social Networking	91.7%	1.4
Instagram	Image Sharing	79.2%	1.4
YouTube	Video Sharing	76.0%	1.3
LinkedIn	Social Networking	44.5%	1.2
Flickr	Image Sharing	13.4%	1.2
Bookstore	Textbook Marketplace	9.8%	1.1
Google	Search	9.5%	2
OmniUpdate	Content Management System	7.4%	1
Pinterest	Image Sharing	7.0%	1.1
Snapchat	Social Networking	6.7%	1
Outlook	Email	5.5%	1.2
Vimeo	Video Sharing	5.5%	1.8
YouVisit	Virtual Touring	3.7%	1.2
BrowseHappy	Software Downloads	3.6%	1
Google Mail	Email	3.3%	1.3
Microsoft Online	Email	3.2%	1
Adobe	Software Downloads	2.7%	1
EthicsPoint	Reporting System	2.6%	1

^a This dataset was collected from homepages provided from a previous dataset of college and university Twitter accounts (Kimmons et al. 2017), so links to Twitter would be represented at close to 100% and absolute percentages may not be representative of institutional websites broadly

students while they are learning online,” then are our attentions where they should be?

Such missing links and lack of emphasis on social issues, especially in cases that should be of paramount interest to educational technology (like digital divides, accessibility, and privacy), suggests that the field may be struggling to orient its work toward solving relevant real-world problems, and researchers should consider how their efforts can more meaningfully inform socially-responsible policy and practice. Some specialized research areas and methods show focus and promise in this regard, such as “open education” or “open educational resources,” which was represented in 1.6% of abstracts, and “design research” or “design-based research,” which was represented in 1% of abstracts, but such tokens seem a pittance when compared to pressing social needs of the day.

As another promising example, in a recent special issue of *TechTrends*, guest editors Dickson-Deane et al. (2018) argued that “we cannot accurately understand how best to attend to issues of learning and technology without acknowledging that culture permeates all environments in which learning takes place, and every technology created and implemented reflects and is imbued with aspects of the culture(s) of its creator” (p. 310). Over the past 5 years, 6.9% of abstracts in these journals have mentioned a variant of the word “culture” (such as “sociocultural”), which, though small, suggests some growing interest and recognition of the topic’s importance to the field.

As we continue moving forward together, it is my hope to continue this editorial each March for documenting ongoing trends of educational technology as well as our growth and development as a field for the previous year. Using public data sources like these as an ongoing litmus test can potentially help us to bridge the research-practice divide and to better align research activities with emergent needs. In future versions, I plan to also include analyses of social media data and other sources to show these trends through more lenses that also account for what practitioners are sharing, what they are finding to be of value, and what problems they believe to be important. Hopefully, as we continue in this exciting and important work, we can refine these data collection processes and also refine our efforts as educational researchers and practitioners to allow for closer alignment between our research and practice efforts while also striving for greater harmony between our professional efforts and the creation of a better, more equitable world.

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