

Analyzing attitudes of students toward the use of technology for learning: simplicity is the key to successful implementation in higher education

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Abstract

Purpose – Research has shown that the much-anticipated technology revolution in higher education has failed to come to fruition. The arrival of ‘digital natives’ millennial students to higher education was presume to present even greater challenge concerning technology use. In light of these gaps, this research aims to capture higher education students’ choice, use and preferences of technology in learning and teaching.

Design/methodology/approach – A paper-based questionnaire was distributed to third and fourth year students of industrial engineering and management at an engineering college in Israel. The students were asked to indicate their use of devices and technologies for learning, their frequency of use and their purpose of using.

Findings – Students extensively use a variety of technologies for learning. They prefer to use the same technologies for learning that they use in their personal lives – mainstream, commercially available technologies – rather than those offered by the institute. They perceive technology as a learning tool more than as a logistic/administrative tool, they would like technology to be more easily accessible and that it not be used as a facilitator of pedagogical change.

Practical implications – The results indicate that technologies intended for use in teaching should be designed similar to commercially available alternatives that are simpler to use and more appealing.

Originality/value – This study provides an up-to-date view of students’ perceptions of technology for learning that can be used to more effectively implement teaching technologies in higher education.

Keywords Higher education, Technology use, Learning, Student perception, Student preferences

Paper type Research paper

Introduction

Countless studies have demonstrated the possible benefit of incorporating technology into higher education (Harasim, 2000). These studies showed that technology has the potential to personalize and enhance student engagement (e.g. Arnold and Pistilli, 2012), improve student performance and elevate student satisfaction (e.g. Klobas and Haddow, 2000). Moreover, technology can be exploited to achieve these and other common educational goals at a reduced cost when compared to teaching in the absence of such technological support (Morris, 2008). Nevertheless, the technological transformation anticipated in higher education has not materialized, and, aside from extreme circumstances during the worldwide pandemic, mainstream academic teaching has not changed profoundly (Flavin, 2016; Henderson *et al.*, 2017).

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Millennials (i.e., people born after 1980), were defined as “digital natives” and are considered as sophisticated users of technology (Prensky, 2001). However, studies undertaken during the previous decade reveal that the use and perception of technology by digital-native students do not demonstrate the profound changes expected for teaching and learning in higher education (Caviglia *et al.*, 2018). For example, Gallardo-Echenique and Anchapuri (2019) found by surveying more than 200 students enrolled in an online module that students did not like to use technology to interact with their peers and instructors. Furthermore, Sørensen (2018) suggests, citing others, that the view of students as digital natives is narrow and even may be wrong.

This research examines the technologies used by students for learning, the purpose of technology use and opinions about whether technology should be incorporated more extensively in academic teaching. A primary goal of the research is to deepen the understanding of millennial use and preferences regarding technology in higher education. The relevant background is presented in the next section, followed by the presentation of the methodology deployed to achieve the study’s goal. In the final two sections, the results of the study are detailed and discussed.

Background

During the past few decades, students have enjoyed growing technology access and ownership compared to their peers in the past (Conole *et al.*, 2008; Kennedy *et al.*, 2008; Henderson *et al.*, 2017). However, Corrin, Lockyer and Bennett (2010) as well as Henderson *et al.* (2015) revealed that students exploit technologies more in their personal lives but less in their learning and students’ ability to transfer their digital competencies from their social to their academic lives. Informal learning, that is, learning activities undertaken by the student individually or collectively without instructors’ presence or requirement of the instructor, differs from formal learning based on the control over the learning objective and process (Deng and Tavares, 2015, citing others). While instructors’ use of technology in teaching has been studied extensively, technology use by students for informal learning has received less attention (Deng and Tavares, 2015; Sørensen, 2018).

Several studies found that the use of technology for learning by students often involves, for the most part, mainstream applications such as Facebook and Dropbox (Echenique *et al.*, 2015; Lai and Hong, 2015; Thomsen *et al.*, 2016; Sørensen, 2018; Caviglia *et al.*, 2018). More specifically, according to Thomsen *et al.* (2016), students use commercial software for learning in parallel with, or as an alternative to, the digital infrastructure offered and maintained by their academic institution. Similar findings emerge from the research of Bond *et al.* (2018), who surveyed approximately 200 German students and found that they use lecture recordings less frequently than online videos; they also used their personal email more frequently than their academic email. These findings seem to portray a lasting situation, as Conole *et al.* (2006) determined a decade earlier that students relied, in their studying, on their personal email and instant messaging accounts more than they relied on the equivalent academic services. Students may find the formal learning platform of their academic institutions (i.e., learning management system) to be a most important technology and essential for their learning. However, they indicated more frequent use of commercially available technologies (such as Google Drive and Facebook) than the use of the learning management system for that purpose (Caviglia *et al.*, 2018). On the other hand, Flavin (2016) found that students preferred to demarcate the technologies they use in their personal lives from those used in their academic lives.

Investigations have been undertaken to identify what students feel are the most useful features of the technologies they use in academic teaching and those technologies they think should be used. These studies tend to show that students express relatively simple and

conservative tendencies. As such, they emphasize the logistic benefits of technology (Thomsen *et al.*, 2016; Henderson *et al.*, 2017) and seem to want more of the same, with faster access and greater volume (Pechenkina and Aeschliman, 2017). Beyond logistics, students seem to exploit technology for a wide range of learning activities, such as communicating with peers and supplementing conventional learning materials (Caviglia *et al.*, 2018) and, albeit to a lesser extent, (Henderson *et al.*, 2017).

Thus, a dual gap between expectations and reality emerges from the literature. One aspect of this gap is the difference between the potential of technology and its realization by instructors; the other is the difference between the perception of millennials as digital natives who display an extensive use of technology in their personal life and their use of that technology in learning. Against this background, this study seeks to facilitate a current and detailed understanding of student use of technology in informal learning and their wishes regarding the use of technology in teaching. Specifically, the research examines the purpose and frequency of technology use in informal learning situations and relates that to the opinions of students about how technology can be more effectively applied by instructors in higher education. The study further addresses a rather current and comprehensive group of relevant technologies, exploring a range of the possible benefits to students who incorporate the use of those technologies. Additionally, the study seeks to reveal the unfulfilled expectations and desires of the students regarding technology use in teaching. Such exploration would, hopefully, contribute to our understanding of how technology in general and, specifically, which technologies can be used to support teaching and learning in a way the students of today, and tomorrow, would find appropriate, thus fulfilling the potential of technology.

Methodology

This research is based on anonymous survey data gathered through paper-based questionnaires, adapted from Margaryan *et al.* (2011) and Henderson *et al.* (2015). The questionnaire was revised to be more suitable for engineering students and to address commonly used technologies in the country where the research was conducted (Israel) when data collection took place. In particular, the questionnaire did not inquire about blogs, which are not particularly relevant to engineering students, nor about the Myspace and Bebo applications, which are not commonly used in Israel. The questionnaire is comprised of four parts. Part 1 aimed to collect data about demographics—age, gender and year of study (3 or 4). Parts 2 through 4 of the questionnaire are presented in detail in the Appendix and described in the next three paragraphs.

Part 2 explored the use of digital devices for learning, presenting four devices: desktop computer, laptop, tablet and mobile phone. Respondents were asked to use a 1 to 4 scale for the frequency of their use of each device for learning purposes, with 1 being the most frequent and 4 being the least. Part 3 of the questionnaire explored the frequency of technology usage by the students. The respondents were presented with technology categories (e.g. text messaging or file sharing), and corresponding applications (e.g. SMS and WhatsApp or Dropbox and Google Drive). They were then asked to indicate how often they used each application, on average, for learning purposes, where 4 represented a few times a day, 3 - a few times a week, 2 - once a week, 1 - a few times each semester or year, or 0 - never. They were also asked to indicate which application in each category they used most frequently. To ensure that all student-used technologies were accounted for, an open question inquired about whether other technologies not mentioned in previous questions were also used.

Part 4 of the questionnaire contained the same categories and examples of applications as in Part 3, but in this part, the respondents were asked about its purpose. Purposes of use responses could indicate verifying student understanding of the learning materials,

improving student understanding of the learning materials, preparing homework assignments and study for exams, organizing course-related materials or saving time. To fully capture student perceptions, the final item was an open question asking the respondent to declare which technology should be introduced for use or used more often than presently in teaching and how best to introduce that specific technology.

The survey was distributed to students in an industrial engineering college’s industrial engineering and management department a couple years ago. Junior (third-year) and senior (fourth-year) students in two courses completed the survey after taking the final exam. In gratitude to the participants for devoting time to respond, they received one bonus point toward their final course grade. To maintain participant anonymity, their names were kept separate from the completed questionnaires. Of the 38 respondents, as depicted in Table 1, 55.3% were males, 57.9% were fourth-year students and 71% fell in the age range of 26 and 30 years old. The data collected from the respondents, and the analysis of that data, are presented in the next section.

Results

This section presents the student responses in three parts, according to the structure of the questionnaire: digital devices used, frequency of use and purpose of use.

Use of digital devices

The analysis of responses about the use of digital devices for learning showed that the most frequently used devices were laptops and mobile phones (Table 2). None of the students indicated a tablet as the most frequently used device.

Frequency of technology use

Respondents indicated their use of anywhere from 5 to 13 of the technology categories presented in the questionnaire. On average, 10.3 technology categories were used in general, and 2.95 technology categories were used a few times a day. As shown in Table 3, the most frequently used technology categories were messaging, email, general-purpose software and

		Frequency	Percent	
Age	20–26	9	23.7%	Table 1. Descriptive statistics of respondents
	26–30	27	71%	
	31–35	2	5.3%	
Gender	Female	17	44.7%	
	Male	21	55.3%	
Year of study	Junior (3rd)	16	42.1%	
	Senior (4th)	22	57.9%	
Total		38	100%	

	Desktop computer	Laptop	Tablet	Mobile phone	
Most frequently used device	8.6%	73.7%	0.0%	21.6%	Table 2. Frequency of digital device use for learning
Second most frequently used device	14.3%	23.7%	5.6%	54.1%	
Third most frequently used device	42.9%	2.6%	27.8%	21.5%	
Fourth most frequently used device	34.3%	0.0%	66.7%	2.7%	

Table 3.
Frequency of student
use of technology
category (in
percentages)

Technology	Frequency of use					Median*
	Few times a day (4)	Few times a week (3)	Once a week (2)	Few times a year/ semester (1)	Never (0)	
Messaging (SMS, WhatsApp, etc.)	68.4%	31.6%	0%	0%	0%	4
File sharing (Dropbox, Google Drive etc.)	15.8%	23.7%	5.3%	52.6%	2.6%	1
File collaboration (Google Forms, Skype, etc.)	5.3%	15.8%	7.9%	50%	18.4%	1
Internet videos (YouTube, Facebook, etc.)	26.3%	26.3%	7.9%	31.6%	5.3%	3
Lecture recordings	0%	2.6%	0%	31.6%	65.8%	0
Wikipedia	5%	18.4%	16%	44.7%	15.8%	1
Internet forums	0%	2.9%	2.9%	54.3%	40%	1
Voice call over the Internet (Skype, Viber, WhatsApp, etc.)	10.5%	23.7%	7.9%	36.8%	21.1%	1
General-purpose software (MS Word, MS Excel, etc.)	37.8%	43.2%	8.1%	8.1%	2.7%	3
Email	76.3%	18.4%	2.6%	0%	2.6%	4
Online courses (Khan Academy, Coursera, etc.)	0%	7.9%	5.3%	42.1%	44.7%	1
Electronic academic resources (eJournals, eBooks, etc.)	5.3%	5.3%	7.9%	55.3%	26.3%	1
Internet search	44.7%	26.3%	7.9%	10.5%	2.6%	3

Note(s): *Values between zero (never use the technology) and four (use the technology a few times a day)

Internet search. The least frequently used were lecture recordings, Internet forums and online courses. In addition, the responses showed that the specific technologies most frequently used in each category by respondents were WhatsApp for text messaging (76.3%), Dropbox and Google Drive for file sharing (92.1%), Google Drive and Google Docs for file collaboration (63.2%), YouTube for Internet videos (73.7%) and WhatsApp and Skype for calls over the Internet (76.3%). Lastly, in response to the open question inquiring about technologies used by the students for learning purposes but not listed in part 3 of the questionnaire, no respondent indicated an additional unlisted technology.

Purposes of technology use

Table 4 details the percentage breakdown of students using each technology category for each purpose. Text messaging, the most frequently used technology, also exhibited the widest diversity of purposes. The purpose of web search, also mentioned as being frequently used, was mostly intended to verify and improve student understanding of the course material and less so to prepare homework assignments or to study for an upcoming exam. The purposes for using each technology vary remarkably from almost 40% to verify and enhance one's understanding of the material to 24% to address course requirements and to organize course materials to 19% to save time.

In response to the final questionnaire item, 31.6% of the respondents mentioned that lecture recordings should be incorporated and used (or more intensively used) in their courses (e.g. more courses recorded, improved recording quality). Likewise, 28.9% would like to see file sharing used more extensively, both between the lecturer and the students and among the

Purpose Technology	Verify understanding	Improve understanding	Assignments and exams	Organization	Save time
Messaging	60.5%	50.0%	39.5%	39.5%	34.2%
File sharing	15.8%	36.8%	42.1%	47.4%	21.1%
File collaboration	21.1%	13.2%	34.2%	44.7%	21.1%
Internet videos	47.4%	73.7%	10.5%	5.3%	15.8%
Lecture recordings	28.9%	34.2%	2.6%	2.6%	5.3%
Wikipedia	52.6%	42.1%	10.5%	0.0%	13.2%
Internet forums	34.2%	42.1%	10.5%	2.6%	7.9%
Internet voice calls	36.8%	26.3%	31.6%	13.2%	34.2%
General purpose software	13.2%	13.2%	52.6%	55.3%	18.4%
Email	31.6%	23.7%	34.2%	63.2%	31.6%
Online courses	36.8%	50.0%	0.0%	5.3%	15.8%
Academic E-resources	52.6%	42.1%	18.4%	15.8%	7.9%
Internet search	68.4%	65.8%	42.1%	21.1%	21.1%
Average	38.5%	39.5%	25.3%	24.3%	19.0%

Table 4.
Percentage of students
using each technology
category and the
purposes for its use

students. Of the students who cited the need for greater use of file sharing technology, 72.7% mentioned as the desired technology public commercial services like Google drive and Dropbox. Moreover, 31% of the respondents used specific names of general purpose commercial software or services. Specifically, YouTube was mentioned by 15.8% of respondents as a technology that they would like to be used more in teaching, while instant messaging with the instructor, forums and electronic resources were mentioned as such by 5.3%. None of the respondents mentioned a technology that was missing from the questionnaire. These results are discussed in the next section.

Discussion

While [Margaryan et al. \(2011\)](#) found that more students used desktop computers than laptop computers, our findings suggest that the digital devices that respondents used most commonly were laptops and mobile phones. This finding is similar to [Händel et al. \(2020\)](#), who found smartphones and laptops to be used more frequently by students than tablets and desktop computers. This increased use of laptops and smartphones is probably due to the time that elapsed between the studies, during which size, weight and price of laptops decreased markedly and mobile phones became smarter. It seems that both digital devices are attractive for students at present, due to portability and multi-functionality.

Preferences of the respondents to support the learning activities using dominant and widespread technologies, like YouTube and Google Docs, is in line with the findings of [Caviglia et al. \(2018\)](#). They found Google Drive, Google Docs and Facebook to be the technology most frequently used by students. The findings of [Henderson et al. \(2017\)](#), which showed that student technology use was typically conventional rather than creative or innovative, support [Caviglia et al. \(2018\)](#). A possible explanation for these results that contradict the expectations of current students may lie in the famous question “If you build it, will they come?”. The fact that millennial students are technology-savvy (i.e., the technology is perceived as easy to use), and that the technology is available does not ensure its use. It is possible that perceived usefulness, a strong determinant of technology use (Technology

Acceptance Model, [Davis, 1989](#)), is not clear to the students. Further research focusing on the perceived ease of use and other factors of technology adoption (e.g. compatibility or trialability, [Rogers, 2003](#)), may facilitate a better understanding of these findings.

Another interesting finding is student desires to use their preferred technologies for both learning and their personal life, as evidenced by the majority (over 70%) being in favor of using commercial file sharing (e.g. Google Drive, Google Docs and Dropbox). Also interesting is that no respondent mentioned the institution's learning management system (which supports file sharing) or any other platform offered by the institution. Likewise, strong preferences were expressed for using internet videos as a source for learning the course material, as opposed to using the institute's lecture recordings for the same purposes. This technology choice was despite the very limited numbers of Internet videos in the students' mother tongue. Similarly, text messaging, email and Internet search, which are in regular use in nonacademic settings, were mentioned most frequently as being supportive of learning.

As suggested by others ([Conole et al., 2006](#); [Roblyer et al., 2010](#); [Bond et al., 2018](#)), but in contrast to [Flavin's \(2016\)](#) assertion about the demarcation between technology used for learning and that used in other activities, the students who participated in the present study preferred the familiar technologies they used in their personal and social lives. These results match the fact that responding students viewed learning and meeting course requirements as the primary purposes for technology use, rather than to save time, i.e., the students view technology as assisting them with their objectives and responsibilities, rather than as an administrative tool. This view is in line with [Anastasakis et al. \(2017\)](#), who found that students harness technological and other resources for learning purposes, rather than practical ease of access in terms of place and time. However, this contradicts [Henderson et al. \(2017\)](#), who found that student self-initiated use of technology was for purposes of flexibility and efficiency.

The strong preferences for simple and familiar technologies found in this study may offer an explanation for the use of technology in higher education and in students' personal lives during the extreme circumstances of the coronavirus pandemic. In the first half of 2020, with the breakout of the virus pandemic and its consequent lockdown, higher education around the world was required to undergo an almost instant transformation to online teaching. Many organizations, including most within the higher education environment, did so using Zoom (and other conferencing tools). Studies that explored student reactions to this situation portray a complex picture and list an abundance of difficulties encountered by students, including those centered on technology. Problems depicted range from lack of equipment and computer network stability to self-discipline, mental stress and depression (e.g. [Sun et al., 2020](#); [Xiao et al., 2020](#)).

Yet, the authors found no indication for students' difficulty or dissatisfaction with the specific conferencing technology choice, specifically with Zoom. This is especially noticeable because Zoom was designed to provide interactive solutions for businesses ([Zoom, no date](#)), not as a virtual class or teaching tool. This may be explained by the fact that one of the Zoom advantages over other conferencing tools is its ease of use and intuitive user interface (e.g. [UNIFY SQUARE, no date](#); [Stone, 2020](#)). Furthermore, in this case it seems that the technology choice dispersed in the opposite direction, from academia to the students' personal lives, as they started to use Zoom for social interaction ([Lorenz et al., 2020](#)), once again using what is available, familiar and easy to use.

The perceptions of higher education students toward the technologies used in learning and teaching revealed by this study were unexpected. These findings should be treated with caution due to the main limitation of the study – its sample. Although the response rate was 100% (all the students who were asked to fill out the questionnaire did so), all of them study in the same department, in a single higher education institution. Further research with a more diverse response pool (i.e., students from numerous departments or higher education

institutions, or both, and a larger sample size) could facilitate the validation of these research findings.

The findings of this research, in line with those of some other studies (Caviglia *et al.*, 2018; Naveh *et al.*, 2012; Pechenkina and Aeschliman, 2017), reveal a gap between technologies offered by academic institutions and used by instructors, and students' informal use of technology. A surprising and noticeable example is student preferences for online videos rather than the institutions' lecture recordings. These results were found in the current study and in a previous study by Bond *et al.* (2018), despite language limitations. This inclination may suggest that students are "voting with their feet", indicating that lecture recording uploaded as-is was not good enough. Institutions that seek to support student learning may wish to address this issue and devote some resources to ensure that uploaded videos provide a service that students find to be valuable.

In more general terms, to close the gap between technology offered by the institution and students wishes and tendencies, policymakers in higher education may consider exploiting the dominant, commercially used technologies and services that are used and preferred by students, as suggested by Caviglia *et al.* (2018). Alternatively, current institutional teaching technologies could be redesigned to look and feel more like widely available and easily accessible commercial technologies. Further research may focus on exploring in more detail the characteristics of technology that make it easy and attractive for students to adopt, as has happened around the world during the 2020 academic year with Zoom and other conferencing tools.

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Appendix

Parts 2–4 of the questionnaire

Part 2

Indicate the frequency of use of devices for learning purposes. Mark "1" for the device you use most frequently, "2" for the following and so on ("4" would be the device you use the least frequently).

Device	Frequency
Desktop computer	
Laptop	
Tablet	
Mobile phone	

Part 3

For each of the following technologies, indicate the frequency (if at all) you use it for learning purposes (but not as part of course requirements)

Tech.	Freq.	Several times a day	Several times a week	Once a week	Several times a semester/yr.	Never used	Indicate the technology you use the most
1. Messaging (SMS, WhatsApp, etc.)							
2. File sharing (Dropbox, Google Drive etc.)							

(continued)

	Freq.	Several times a day	Several times a week	Once a week	Several times a semester/yr.	Never used	Indicate the technology you use the most
Tech.							
3.	File collaboration (Google Forms, Skype, etc.)						
4.	Internet videos (YouTube, Facebook, etc.)						
5.	Lecture recordings						
6.	Wikipedia						
7.	Internet forums						
8.	Voice call over the Internet (Skype, Viber, WhatsApp, etc.)						
9.	General-purpose software (MS Word, MS Excel, etc.)						
10.	Email						
11.	Online courses (Khan Academy, Coursera, etc.)						
12.	Electronic academic resources (eJournals, eBooks, etc.)						
13.	Internet search						

Do you use a technology that was not mentioned: yes/no
If yes, please indicate which technology:

Part 4

For each of the following technologies, indicate the purpose(s) for which you use it or the benefit(s) it confers on you (mark with an "X" all the benefits that are relevant)

Technology	Benefit				
	Verify understanding of course material	Improve understanding of course material	Prepare assignments and learn for exams	Organize course materials and learning	Save time
1. Messaging (SMS, WhatsApp, etc.)					
2. File sharing (Dropbox, Google Drive, etc.)					

(continued)

Benefit	Verify understanding of course material	Improve understanding of course material	Prepare assignments and learn for exams	Organize course materials and learning	Save time
Technology					
3. File collaboration (Google Forms, Skype, etc.)					
4. Internet videos (YouTube, Facebook, etc.)					
5. Lecture recordings of a previous course given at the college					
6. Wikipedia					
7. Internet forums					
8. Voice calls over the Internet (Skype, Viber, WhatsApp, etc.)					
9. General-purpose software (MS Word, MS Excel, etc.)					
10. Email					
11. Online courses (Khan Academy, Coursera, etc.)					
12. Electronic academic resources (eJournals, eBooks, etc.)					
13. Internet search					

Which technology should be used (or should be used more extensively) in college courses? How should it be used?

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