Altruism as a Motivational Factor in Student Technology Adoption

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"Representation and communication are motivated by the social; its effects are outcomes of the economic and the political. To think or act otherwise is to follow phantoms." (Kress, 2005, p.6)

Inclusivity has become a cherished value within academia, as both cultural norms and legislation prod our educational system to improve access for marginalized communities. Interest in accessibility is on the rise, as recent studies estimate that 11 percent of our students have declared at least one disability (National Center for Education Statistics). In the United States, the rights of students with disabilities are guaranteed through Section 504 of the Rehabilitation Act of 1973 as well as a patchwork of state and federal statutes aimed at improving access to education.

Developing pedagogies that enhance access for all students requires that we examine our practices in the classroom. Many educators and instructional technologists are embracing the concept of Universal Design (Mace, 1988) by striving for texts and teaching environments that can be of use to all students, rather than demanding that students declare their disabled status in order to receive specialized accommodation. The texts through which we communicate the substance of our courses (e.g., syllabi, readings, lecture notes) are of particular interest to the current research, which focuses on the reaction of able-bodied students to the introduction of EPUB, a relatively new and highly accessible document format.

As Kress (2005) explained, this topic is both technological and political. Accessibility is not simply a state of being, it is a status that is given or denied by those who control the means of access. Printed books – for centuries, the primary platform for information transfer – are inaccessible to those without sight unless assistive technologies are made available to the affected audience. Whether such interventions are adopted easily or contentiously depends on the majority's interest in providing access. Universal Design advocates a single solution that works for all; as such, any successful effort to improve the accessibility of our documents must first win the approval of the majority. In the case of EPUB versus PDF, the choice of document format is more than semantics – this discussion pits our traditional fixed-layout designs (also known as *pages*) against a modern reflowable presentation style. To elaborate the fundamental importance of this issue, it will be necessary to clarify a number of concepts that typically go unexamined.

Our digital era compels us to leave behind notions of the book as a collection of printed paper rectangles bound between covers for a more essentialist idea: the book as a self-contained, portable collection of content that affords both presentation and navigation capabilities. The concepts of being self-contained and portable are key, because texts that do not satisfy those objectives (e.g., *webtexts*) require ubiquitous Internet access – a concept which disadvantages students without home Internet access, whose only off-campus connectivity may come from bandwidth-limited cellphone plans. Just as importantly, webtexts rely on the publisher to maintain uninterrupted online storage while self-contained portable documents may be downloaded and archived by the students themselves, guaranteeing access to key texts during future semesters. Digital documents exhibiting these properties are often called *e-books*, although their contents might amount to only a single page.

This study's participants interacted with two e-book formats: the ubiquitous *Portable Document Format* (PDF) and the less well-known *EPUB* (not an acronym). As such, it is important to explain the concerns over their use that inspired this research.

Prior to the arrival of Adobe's PDF technology, exchanging "native documents" was the status quo. This practice suffered from several disadvantages: the recipient needed to own the same software used by the author, graphics might fail to appear when the document was opened, and the recipient needed to install and activate the same fonts used by the author to avoid unwanted text re-wrap (due to the substituted font's differing character width). PDF resolved these issues by encoding fonts and images into a single file that could be viewed and printed using Adobe's free Acrobat Reader software. PDF's success in ameliorating the exigency created by the exchange of native file formats resulted in its rapid – and largely unexamined – adoption within academia. Soon after, the advent

of *screen reader* software allowed the text within PDF files to be read aloud to visually impaired computer users. Interest in providing greater accessibility led Adobe to add an additional layer of structured data (including reading order instructions as well as alternate descriptions for images) to the PDF format. These accessibility features, however, are not required components and are separate from the PostScript-based object list that creates the PDF's visual representation. Additionally, the process of creating a fully accessible PDF is very complex, is typically only partially completed by authors, and requires the purchase of Adobe's full Acrobat Pro software application.

Due to these concerns, users of assistive technologies cannot be certain as to whether a newly encountered PDF document will be readable, or whether accessibility features will be properly implemented. As a result, assistive technology users may encounter difficulties accessing PDF content. As noted by academic journal editor Trude Eikebrokk (2014, para. 7), "PDF is a format that can cause many barriers, especially for users of screen readers (synthetic speech or Braille)."

The origins of the EPUB format preceded the introduction of Adobe's PDF. In 1993, the Swedish Library of Talking Books and Braille commissioned a commercial software company (Labyrinten Data AB) to develop the Digital Audio-based Information System (DAISY) "talking book" or DTBook, a forerunner of today's accessible EPUB format. This differs from PDF in numerous substantive ways; most notably in that they are easily parsed collections of XHTML, XML, and CSS files. The simplicity of these markup languages stands apart from PDF's mixture of ACSII and binary data (Lukan, 2012), which can only be displayed by applications that support the complex Adobe Imaging Model (Adobe, 2000).

DTBooks were specifically referenced by Rose et al. (2006) in their initial treatise of Universal Design for Learning (UDL) as a format for students with "print disabilities" (Wise, 2016), including dyslexia and other cognitive disorders in addition to various levels of visual impairment. DTBooks were intended to support UDL's requirement for *multiple means of presentation* to accommodate the various ways that students interact with and learn from courseware (Rose, 2006, p. 136). Unfortunately, DTBooks are not actually a good fit with the concept of Universal Design, as DTBooks (and the reading systems used to peruse them) are not intended for use by the sighted majority.

Recently, the DAISY Consortium and many other accessibility advocates have suggested the adoption of EPUB3, a recent iteration of the EPUB e-book format, as the universally accessible replacement for DTBooks (DAISY Consortium, 2011) but their voices are struggling to be heard in a world dominated by commercial purveyors of "accessible PDF." Progress is evident, however, in the growing number of academic databases that contain EPUBs (e.g., ABC-CLIO, ACLS Humanities, EBSCO E-Books, Proquest's Ebrary, Elsevier's ScienceDirect, Taylor & Francis), and the many sessions about EPUB found at academic conferences.

The current research responds to a gap in the literature on UDL, in that this heralded learning theory has not yet explicitly adopted DTBook's specified replacement, EPUB3 (DAISY Consortium, 2011). The need to research UDL practices that involve EPUB3 is clear, in that the EPUB3 format is more applicable than DTBook to the underlying premise of Universal Design: that we should avoid the provisioning of alternate accommodations for those who differ from the majority, but instead strive for universally acceptable formats "which, to the greatest extent possible, can be used by everyone" (Mace, 1988, p. 3).

By observing a small number of abled college undergraduates as they interact with EPUB documents and speaking to them at length about that experience, this qualitative research hopes to add to the discussion of whether "typical" college students can be successfully motivated to adopt this new technology. Specifically, my purpose was to better understand the potential for user resistance to EPUB as a replacement for "accessible PDFs" in academic settings, with a special interest in the role that altruism might play as a motivating factor in EPUB's adoption.

Review of Relevant Literature

Society's essentially unexamined embrace of PDF for document distribution is evidenced by the lack of journal articles on the ramifications of its adoption or its alternatives. In response, this study presents an examination of empirical literature that address motivation's role in technology adoption and the value of altruism as one facet of motivation, as well as the invisible nature of non-apparent disabilities, and what appears to be the only previous peer-reviewed research study on student preference for EPUBs.

Motivation and Altruism in Technology Adoption

Altruism was not considered to be an important component of motivation in the seminal work of Vroom (1964). In keeping with the behaviorist thinking of the period, Vroom's expectancy-theoretic model of "motivational force" depicted human behavior as a simplistic effort to gain pleasure while avoiding pain. In his oft-cited research on word-of-mouth communication, however, Sundaram et al. (1998) included altruism as a contributor to motivation, specifically defining it as "the act of doing something for others without anticipating any reward in

return" (p. 529). This concept is key to understanding the inclination of abled readers to adopt the EPUB format in light of its greater accessibility for disabled users.

One established way to examine users' willingness to transition to a new technology is the Technology Acceptance Model (TAM) developed by Davis (1989). Chen et al. (2017) extended Davis' TAM to include the additional motivational factors of social interaction, enjoyment, and altruism. Chen et al. found altruism to be highly significant component of social interaction (p. 8) even though the nature of these interactions was virtual rather than face-to-face. Chen et al.'s research supports a key assertion of this study: that interest in helping others can be a motivational force for technology users. Hernandez et al. (2011) reported on the significance of altruism in determining attitude towards and usage of Information and Communication Technology (ICT) tools. Their research found that participants in online courses were significantly motivated by altruistic feelings toward their classmates, even though the virtual nature of these courses diminished the likelihood that their altruistic behavior would be reciprocated (p. 2228). Hernandez also determined that students were inherently interested in obtaining the approval of the course instructor (p. 2230).

The document formats examined in this research have been included in electronic knowledge repositories (e.g., university library portals, Blackboard's eReserves feature). Kankanhalli et al. (2005) investigated the motivation of knowledge management practitioners and found that the intrinsic benefit of altruism was strongly correlated with the motivation to share knowledge (p. 131).

Disability Non-disclosure

The principal tenet of Universal Design (that the same version of a thing should be usable by everyone, regardless of their particular abilities) becomes even more important when we consider how difficult it can be to identify which students are in need of accommodation.

Kranke et al. (2013) found that "students with non-apparent disabilities encountered stigma from peers and professors" (p. 36), which creates pressure for students to maintain their undisclosed status whenever possible. Students identified a desire for autonomy and normality as additional reasons for avoiding disclosure (p. 43), as well as concern about maintaining compliance with their professor's instructions so as to avoid undermining the professor's view of their capabilities (p. 43).

Salzer et al. (2008) conducted a survey of students diagnosed with mental illness. A majority (56%) said they felt embarrassed when alerting professors to their disability and were fearful that these professors would stigmatize them (p. 373). Forty-two percent of students who had disclosed their condition characterized their professors as being unreceptive or even uncooperative (p. 373). These findings support the position that many non-apparent disabilities go unreported, strengthing the case for universally accessible texts as a way to obviate the need for student self-reporting.

Digital texts in the classroom

Literature on the use of self-contained, portable electronic document formats in the classroom (as opposed to HTML-based presentations) is in short supply; studies that compare multiple forms of electronic documents are rare. Standalone, archivable document formats, however, deserve in-depth analysis because the format that emerges as our final choice will become the accepted replacement for printed class texts.

In what may be the only peer-reviewed study of its kind, Mills (2016) conducted a quasi-experimental test of student preference between a course textbook distributed in one of three e-book formats: PDF, KF8 (Amazon Kindle documents), and EPUB. Some students received an EPUB containing interactive content, while others received either a PDF file or a KF8 (Kindle) file. Participants who received the EPUB file reported significantly higher levels of interaction and engagement with the course text, as well as greater perceptions of the text's usefulness and value (p. 130). These findings support the current research's recommendation of EPUB as a format well-suited for sighted readers as well as users of assistive technologies.

Reviewing this published literature provided an understanding of several relevant issues. Despite being overlooked in early work on the topic, altruism has been empirically shown to affect motivation and knowledge sharing; as a result, any modern investigations of technology acceptance should include altruism among their motivating factors. This review also lends credence to Universal Design for Learning's recommendation of texts that are compatible with assistive technologies, since the non-disclosure of psychiatric and attentional disabilities is problematically low, contributing to a large number of students who avoid requesting accommodations despite awareness of their availability. We also see that while much more research needs to be done in the area of student digital textbook preference, at least one prior study has identified a student preference for EPUBs over PDFs or Kindle books. While each piece of literature reviewed offered some valuable contextualization of the issues at hand, none specifically addressed the practical question at the heart of this research: if we recommend EPUB3 in response

to Rose's call for the use of highly accessible document formats in our classrooms, can abled students be motivated to adopt this new technology?

Methods

The purpose of this research is to investigate students' attitudes toward a new instructional technology (EPUB) as a replacement for "accessible PDFs" in academic settings. To further this goal, I conducted qualitative research to discover the actions and opinions generated when students without print disabilities were asked to interact with one document saved as both a PDF and an EPUB. These observed activities, as well as the semi-structured questions that both preceded and followed the hands-on portion of the interview, were designed to cast light on these research questions:

RQ1: What is participants' knowledge of the EPUB format?

RQ2: What challenges are reported or observed when students are learning to access EPUBs?

RQ3: How do participants perceive EPUB's constraints and affordances?

RQ4: According to participants, does a discussion of Universal Design principles increase their interest in the EPUB format?

Research setting

This research took place at a former teacher's college located in a small Midwestern city (population 43,849), located approximately one hour's drive west of Chicago. The university's Fall 2018 enrollment was comprised of 17,169 students (including 1,211 international students), 75% of whom are undergraduates. Males make up 50.8% of the undergraduates, while 49.2% are female. The average undergraduate student age is 22. Fifty-five percent of these undergraduates self-identified as White, 15.8% as Black, 17.9% as Hispanic/Latino, and 5.4% as Asian. As a university with a significant international enrollment located near America's third most populous city, it is considerably more diverse than the county in which it is located, i.e., 86.6% White, 11.4% Latino, 8.1% Black, 2.8% Asian (U.S. Census Bureau).

Participant demographics

Six undergraduate students (ages ranging from late teens through early 20s) from this Midwestern university were interviewed; the sample consisted of an even split between male and female participants; 50% were Black (one female, two male), and 50% were White (two females and one male). Each student was enrolled in a different major: Accounting, Communications, Kinesiology, Nursing, Psychology, and Special Education. The participants comprised a convenience sample drawn from my former students from an on-line class; 12 students were invited to participate via email, but only six responded affirmatively (50% response rate). Students' participation was incentivized through an offer of $15 cash, which was given to the interviewee at the start of each session.

Data collection and analysis

Data was gathered during individual face-to-face interviews; each interview lasted between 28 and 45 minutes. The interview site was a small conference room on campus. The participants were asked to examine the same document in two different formats (PDF and EPUB) on whatever computing platform they preferred; half of them (three) used a laptop, while the other half (three) used a smartphone. Among the laptop users, two were running Microsoft's Windows operating system while one was running Apple's MacOS. All three smartphone users interacted with an Apple iPhone. While using these devices, the participants were asked to interact with the two documents in various ways: scrolling, reading, searching, navigating to a specific section, and enlarging the document's text.

These interviews were recorded with a high-definition video camera placed behind the students' right shoulder in order to capture their hand movements as they interacted with an EPUB on their device of choice. These video recordings allowed me to replay and closely observe the students' interactions with the hardware and software used to access the documents, in order to note any challenges or general patterns that emerged from their use of these familiar and unfamiliar document formats.

Audio from these recordings was transcribed via F5 Transcription Pro software for open coding in Nvivo 12 for Mac. An initial pass through all six transcriptions produced 24 codes; a second pass caused me to merge two codes then organize thirteen others under six top-level codes. This resulted in a total of 16 top level codes from which to generate themes. Several of these were related to aspects of motivation (altruism, compliance, efficacy, convenience) while others applied to the hands-on tasks performed by participants during the interview (e.g.,

controlling text size, navigation, search/find) or their own statements on various related concepts (e.g., awareness of EPUB and Universal Design, general challenges with reading texts, preferred study locations).

Researcher role

  The class during which I previously became acquainted with these students was conducted online rather than face-to-face, so our relationship remained relatively impersonal. My role as their former instructor and our substantial age differences made them likely to perceive me as an "outsider," although our shared experience of the online course might also have granted me a small measure of "insider" status. As Dmitriadis (2001) observed, the researcher is always some mix of insider and outsider, and so I endeavored to keep both attributes in the proper perspective. Acknowledging and accounting for such concerns is an essential task for researchers, according to Dmitriadis, since these multiple versions of our identities "often work at distinct cross purposes and can inextricably complicate and even derail our research as we originally conceive it" (p. 579).

Concerns

  My "insider" role (garnered through my identification as a member of the study group) seemed unlikely to pose a substantial problem due to the impersonal nature of our prior distance-learning relationship, but a larger concern came from our previous shared experience with the topic of EPUBs. These students were selected specifically because I knew they had some small familiarity with the idea of an EPUB file as a self-contained portable document format. They gained this knowledge by participating in an extra-credit assignment as students in my online class; each had earned a small improvement to a previous assignment grade by downloading one short EPUB file from our class website (on Blackboard), then taking a short quiz about their interaction with the document.

  Just as these participants came to their interviews with a small amount of pre-existing familiarity with this topic, I too brought my own prior knowledge to our sessions. Having interacted with more than a half-dozen sections of undergraduates during prior teaching experiences, I held some assumptions about their existing skill level when it came to digital technology. Upon reflection, I determined that the participation of these students in the current research was appropriate, as their past experience would reduce the initial strangeness of the EPUB format, thereby allowing for a more accurate appraisal of their abilities to interact with it. Additionally, it was undoubtedly clear to these participants that I am an advocate for the use of EPUBs within academia. However, at the point when this research occurred, they were no longer my students and had no compelling reason to modify their behavior in order to gain my favor. In addition, I feel that self-reflections on this subject have allowed me to approach this research impartially, as I have remained cognizant of the potential for bias. Such self-reflective writing on the basis for potential bias is one technique recommended by Lawrence-Lightfoot and Hoffmann Davis (1997), who noted that "making the anticipatory schema explicit (in the form of memos, journals, or self-reflective essays) allows for greater openness of mind" (p. 186).

Findings

  The current research was conducted to collect student perspectives on the adoption of a new instructional technology, i.e., EPUB. My initial expectation was that participants might speak of altruism's connection to technology adoption, in addition to such classical motivations as learning goals and performance goals (Dweck & Leggett, 1988). The statements and observed actions of the participants in this study caused me to rethink those initial expectations, as EPUB's benefits for sighted users came to eclipse the moral advantages of accessibility. The findings that resulted from these interactions have been organized thematically as responses to my research questions. Pseudonyms have been used to protect the participants' identities.

EPUB remains largely unknown to students

  Although these participants shared a past exposure to the existence of EPUB documents gained during an optional extra-credit assignment in the prior semester, they were unanimous in saying that they had not heard of the EPUB format prior to the extra-credit assignment, nor had they heard the term used since that initial exposure. However, two of the participants (Emma and Francine) stated that they were using Apple's iBooks software on their laptops, while Bernadette said that she sometimes used the iBooks app on her smartphone. This indicates an ongoing challenge for those who strive for greater awareness of the EPUB format within academia: software vendors have successfully branded the EPUB books sold on their e-book marketplaces with the name of their particular applications. EPUBs purchased through Apple's iBookstore are referred to as "iBooks," while EPUBs purchased through Barnes & Noble's marketplace for use with their Nook e-readers are called "NookBooks." Even some academic publishers contribute to this lack of name awareness – the University of Chicago Press sends out a

monthly email offering a "free e-book," but subscribers never see the term EPUB in either the initial email or the subsequent HTML landing page.

These branding issues result in a real problem for those who would encourage broader adoption of the EPUB format. Emma, owner of both an Apple laptop and an iPad, said, "I've used iBooks in the past, and I was aware that [the ability to change text size] was available." Her ability to modify font size when reading on her devices (rather than zoom in and out, as with a PDF) indicates that she must have had prior experience reading EPUBs – yet when asked earlier in the interview whether she had ever heard of EPUBs after the prior semester's extra-credit assignment, she said, "No." It will be difficult to build consensus around the advantages of the EPUB format unless users are able to identify this format by name.

Users report minimal challenges during EPUB adoption

In order to participate in the extra-credit assignment previously mentioned, each of the participants had already gone through the process of assuring that they could open and read an EPUB file. For three of the participants, this required no additional effort as they were already using Apple devices that ship with the pre-installed EPUB reader iBooks. Another participant also used pre-installed software to read his EPUB: Dominick, whose recently purchased Windows laptop included Microsoft's Edge browser, which can natively open EPUBs without a plug-in. The remaining Windows-using students reported that installation of the necessary free software to read EPUBs was unproblematic. When I asked Charles whether he thought that other students would find it too difficult to install an EPUB reader onto their preferred reading platform (e.g., laptop, desktop computer, tablet, smartphone), he responded: "I'm pretty sure students are used to being handed something new. Downloading it on their phone and getting used to it." However, a note of caution on this topic was sounded by Anton, who said:
A lot of people are very lazy, don't like to do work anymore. They like a lot of work done for them the easy way and stuff like that, so I feel like it would be a complaint if stuff were harder and they had to put in more work. They would definitely complain.
This indicates the need for students to be motivated to download and use EPUB readers as part of their coursework, a topic that will be explored next.

Motivation through perceived efficacy and convenience

Videotaped observations of users interacting with both PDFs and EPUBs supported their overwhelmingly positive statements regarding their experiences accessing EPUBs, but also yielded some unexpected results. It was surprising to discover these students' minimal knowledge of methods for interacting with PDF documents. Each denied that they had ever used bookmarks to navigate their way through a PDF, or even used the search function to locate a specific term within a PDF; similarly, none were familiar with the highlighting tool built-in to most PDF readers. As a result, students were excited to experience what they perceived to be the greater efficacy of the EPUB format with regard to accomplishing several standard tasks associated with reading course texts: navigation, search/find, and adjusting text size for readability.

The following descriptions of user interactions with EPUB-reading software refer to the two types of Table of Contents (TOC) often found in an EPUB, which I will explain here. One of the ways in which EPUB accessibility is superior to that of PDF is the requirement for EPUBs to make their contents navigable through any reading system's built-in Table of Contents menu (a feature not found in PDF reading systems, even when "accessible PDFs" are used). Often called the *hardware TOC*, this navigation system is immediately available in a consistent fashion from any page of any EPUB. Alternatively, EPUBs may (or may not) also contain an *in-book TOC*, analogous to the Table of Contents page in a printed book. As with a PDF file that contains an in-book TOC, the chapters and sections listed may (or may not) be shown as clickable hyperlinks. The example files provided for the hands-on component of these interviews reflected the typical "real world" state of these formats, in that the EPUB contained a hyperlinked in-book TOC while the PDF did not.

Navigation is made easier by consistent access to a Table of Contents. When asked to navigate to the "third section" of an EPUB viewed in Adobe Digital Editions (ADE) for Windows, Anton said he would scroll. Upon refamiliarizing himself with the fact that EPUBs change pages via a horizontal page-flipping convention rather than the vertical scrolling technique used by most PDF readers, he went to the EPUB's third page. Once I pointed out that he was not at the third *section* but rather the third *page*, he moved backwards through the pages until he found the in-book Table of Contents then clicked on the appropriate hyperlink for the second section. Similarly, Dominick also used the in-book TOC hyperlinks to navigate to the third section when he viewed an EPUB with Microsoft's Edge web browser. When asked to locate the third section of an EPUB within the iBooks app on an iPhone, Francine initially swiped her way through two pages before deciding (without any prompting) to instead click on the icon for iBook's hardware TOC, allowing her to very quickly reach the third section. The remaining

users (Bernadette, Charles, and Emma) all selected the hardware TOC immediately upon being requested to navigate to the third section. Francine's explanation of her behavior was typical of all the participants who accessed the hardware TOC: "If you want to find a page, you just use this scroll thing, but yeah, if I wanted to find a chapter, I would just go to the Contents thing." Suspecting that the simple interface of an EPUB reader made it easy for the participants to recognize standard icon conventions (such as a menu of contents), I engaged Charles in this dialog:

Interviewer: So show me how it was that you got to it. What was the method that you used? [Subject shows the built-in TOC menu.] Oh, so you went right into the navigation system!

Charles: Yeah.

Interviewer: And so even though you'd never touched this phone before, or used that software before, it was intuitive that you could kind of tell that that thing up in the corner was an Index.

Charles: Yeah, it provides like a dropdown list or something.

Interviewer: Yeah, nice. Now are you familiar with seeing something like that in PDFs, or is there any kind of Index that you use when you're going through PDFs?

Charles: Mmm, not that I can remember.

The interviewees' ability to easily locate the hardware TOC within two different EPUB readers (Adobe Digital Editions and Apple iBooks) on three different platforms (a Windows laptop, a Mac laptop, and an iPhone) shows the value of a streamlined user experience that follows consistent user interface conventions.

Search capabilities are underutilized by PDF readers. Surprisingly, all participants denied having knowledge of how to search for a specific term within a PDF file. Several knew the keyboard shortcut for search (control-F on a PC, command-F on a Mac), but only associated that process with web browsers. Each participant found it easy to search for a specified term with an EPUB. Dominick, the student who viewed his EPUB within the Microsoft Edge web browser, used the keyboard shortcut control-F to bring up the search function; the remaining interviewees were all able to quickly identify the magnifying glass icon that represented the EPUB reader's search function. As an example, when asked if she had any idea how to search for a term within an EPUB, Emma responded, "The magnifying glass at the upper right-hand corner."

Conducting a search within a typical PDF viewing application takes the reader to the first highlighted use of that term within the document; if that location is not the desired spot, the user clicks a forward-arrow icon or repeats the keyboard shortcut to be taken to the next highlighted instance of the term. All the EPUB readers used by these participants, however, follow a different convention: conducting a search pops open a floating list of all locations of the term, where each instance includes a snippet of the text surrounding the term (to provide context). The interviewees found that method to be more efficacious. When asked if the search procedure for EPUBs seemed to be the same as she was used to from using PDFs, she said: "No, I feel like this is different. Like you said, usually they just kind of give you the word and then where it is."

Search functions are a key capability for any researcher, but these undergraduates were unfamiliar with how to perform searches in PDFs. This may be a result of teachers' common practice of providing texts to students as unsearchable scanned images, rather than as searchable text. If course materials are not consistently searchable, it is understandable that students would not learn to associate such functionality with the PDF format.

Enlarging text for readability is the key to usability on smartphones. While the laptop users in this study were not overly concerned with text size, the subjects who used a smartphone to access the texts were immediately challenged by the tiny size of text within PDFs. Since the default behavior is for PDF readers to display the full width of the PDF, the text was rendered too small for students to read. Rotating the phone to landscape mode enlarged the PDF to fill the width of the screen; as Charles noted: "I could read it if I focused, but that's going to strain my eyes, so yeah, to turn it sideways would be better." However, the interviewees found it uncomfortable to navigate the PDF when only a small portion of the page was visible, causing them to flip the phone back and forth between portrait and landscape orientation during use.

When the smartphone users examined an EPUB on their mobile devices, they were immediately impressed by the difference in readability. EPUB readers feature reflowable text that is not bound by a particular page geometry, so the default text size was immediately readable. The participants also found it easy and intuitive to change the size of the displayed text by clicking the icon representing text size: two adjacent instances of a capital letter A, shown at different sizes. For the three participants who were using laptops, I demonstrated the default text size on my iPhone. All the interviewees then began to conjecture about how this capability would increase the likelihood that they would use their smartphones to occasionally read assigned texts, especially during short breaks between classes or while traveling. The convenience of being able to use a smartphone to read class texts was noted by all participants. As an example, Bernadette said: "With it being on your phone, you can change the font size to however large or small you need it. So, you can do the reading on the go, so you can get it done." Similarly, Dominick said: "I feel like EPUB on a cellphone would probably be a lot better than a PDF because once again, like

I said, it's all blocks, blocks of text." (Dominick had complained that the vertically scrolling display of PDFs on his cellphone made them appear as dense blocks of text rather than paragraphs.) Charles specifically called out the convenience of EPUB's usability on his mobile device: "I look for convenience. So I usually, if I can read it on my phone and get the job done, then I will." Emma noted that she's likely to have much more opportunity to read course texts on her phone when away from home when she said pointedly, "You never forget your phone!"

Universal Design as a motivational factor for EPUB adoption

The current research found that students were more likely to support EPUB adoption after learning that the format's accessibility is superior to that of PDF. In other words, the resistance of able-bodied students towards any additional effort needed to implement EPUB (i.e., to learn new procedures, and the potential need to download and install free software) could be minimized by an altruistic desire to participate in an accessible Universal Design pedagogy. It is important to note that none of the interviewees who participated in this research self-identified as having a learning disability, and that of these six undergraduates, only two were marginally familiar with the term Universal Design.

Altruism provides only limited motivation for technology adoption. Anton was among the majority who were unfamiliar with the concept, but he soon revealed that he was familiar with the inclusive practices enabled by Universal Design, noting that "We had, like, wheelchairs in our class, kids with disabilities in our class, so now it's like normal for us. Our generation, we're like used to it." He also saw the value of materials and practices that enabled inclusive learning and supported the idea that accessible materials would also be valued by his classmates: "It'd make everybody want to use it [EPUB] more, since they'd know like okay, this isn't just for me, it's for other people too with disabilities and stuff like that." However, when asked how much additional difficulty the typical college undergraduate might tolerate when being asked to adopt a new accessible technology, Anton once again turned skeptical. "If it's more work, yeah, people will complain," he said, "I know my generation, a lot of people are lazy."

The two students who were already familiar with Universal Design supported Anton's view that the majority's largesse could not be taken for granted. Francine, a Psychology student who said that she was broadly familiar with the term Universal Design but had no knowledge of its applications, noted, "I wouldn't be more motivated to use [the EPUB format], because I wouldn't need it, but for other reasons I would be, like the things I said earlier that attracted me to the EPUBs. [She enjoyed the ability to change font sizes or switch into Night Vision mode, as well as swiping through documents.] But unfortunately, that Universal Design thing wouldn't motivate me personally to use it more." Like Anton, she felt that touting the direct benefits to users would be key in easing the adoption path for EPUB. In contrast to Anton's skepticism, though, Francine thought that there would be little resistance if teachers mandated the use of EPUB. "Obviously it would be beneficial to people that need it, whether or not I need it; so, I wouldn't care, personally," she said. "It was a small hurdle. No difficulty for me at all."

When interviewees revealed a deeper personal connection to issues of accessibility, however, Universal Design was identified as being more motivational. Emma, a Special Education major who volunteered that she has "thought about this a lot," said that "The issue isn't whether or not it's fair, it's making sure everyone has the same learning abilities." Her responses were the most specific in this regard, but all the participants expressed some level of support for mainstreaming students with special needs into the general classroom population whenever possible.

Personal connection to disability strengthens motivation for Universal Design adoption. Given that all participants saw the Universal Design component of EPUB as an advantage, it's logical to presume that a personal connection to this topic would lead to a stronger connection and further reduce resistance to implementation. Bernadette, a second-year Nursing student, revealed that her familial relationship with disability has resulted in greater appreciation for the concept of Universal Design: "I think that helps make people more receptive to the idea [of using EPUB]. I come from a home with two brothers who are mentally impaired, so I know it sparks my interest," she revealed. "Because I know my brothers learn at different rates and one likes to read, the other doesn't like to read but likes to listen to things, so I think it would be, like, perfect." Bernadette's response validates an approach in which instructors first make the case for EPUB adoption as an accessible format that can benefit all students before pointing out the ways this new format can benefit the sighted, smartphone-wielding majority.

Compliance

One emergent finding that was not anticipated by this study's research questions is the strong role of compliance on student motivation. As noted by Kranke et al. (2013), students are highly concerned with maintaining a favorable relationship with their instructors – or as Vroom (1964) might have positioned it, to avoid the pain of low grades. Emma echoed a sentiment expressed in various degrees by all the other interviewees – that students would simply accept the transition to a new technology (EPUB) if instructed to do so by their teacher:

If I were to sit down, I came to NIU, I'm a freshman and my teacher – my professor – hands me an EPUB, well that's how I'm going to learn to read and I'm not going to question it. People are just going to get used to it and it's going to become the normal. Because it does have those features for people with special needs or learning disabilities and if they need them they can have them. So, I don't think it's inconveniencing anyone, and I don't think many students would question it.

Some scholars might challenge Emma's statement by citing Activity Theory (Engestrom, 2000); under that premise, students who had operationalized the use of PDF would suffer discomfort when their proximal zone of development was de-centered by the introduction of EPUB (Vygotsky, 2011, p. 203). This research, however, reveals that these twenty-first century scholars have become accustomed to constant change in their selection and use of technological tools. Anton expressed confidence in his classmates' ability to implement the new software needed to read EPUBs, saying that "Everybody's technology savvy these days; everybody knows technology, so it's not really that hard to figure out."

Emma extended Francine's "no big deal" assessment of EPUB adoption by positioning the introduction of new technologies and formats as the duty of the instructor: "I think it's important, especially with technology nowadays, that we're exposing students to that. Not to say textbooks aren't functional, but jobs nowadays will never hand you, 'Here's your [printed] manual.' They're gonna say, 'I'm going to e-mail you that manual.'"

From Emma's point of view, the medium is clearly as important as the message; content wrapped in the outmoded trappings of print culture is seen as having less real-world relevance to today's technology-driven students.

Conclusions and Implications

This study examined the role of student motivation in the adoption of a new instructional technology, EPUB. An analysis of participants' statements and actions during the adoption process led to the identification of four motivational factors: compliance, efficacy, convenience, and altruism.

One unexpected result was that participants placed the greatest emphasis on compliance, as they expressed the desire to use whatever tools were recommended by their professors. As initially assumed, they were also highly interested in the efficacy of EPUB; observation showed that they quickly learned to navigate and search an EPUB's contents as well as adjust its text for optimal viewing on a mobile device. Surprisingly, there was lower (albeit still positive) interest in the other two factors: convenience (i.e., smartphone compatibility) and altruism (*vis-à-vis* EPUB's enhanced accessibility). The altruistic response was more pronounced among students who possessed a personal connection to disability.

Participants expressed positive views of all four motivational factors, so this implies a low potential for resistance when EPUB is introduced into the classroom. These findings validate an approach in which instructors present EPUB as an accessible format that can benefit all students, especially users of assistive technologies. Since the EPUB format was developed by advocates for the visually impaired, it is highly compatible with assistive technologies, thereby reducing the need for students to seek special accommodation. Once instructors introduce the concept of accessibility, they should herald EPUB as a format that is easy to use and smartphone-friendly.

These results have significance for the growing community of educator who have restructured their curriculums around the concept of Universal Design for Learning, as the EPUB format enables a universal approach to the dissemination of course documents. Beyond practitioners of UDL, the EPUB format should be embraced by all educators desirous of truly inclusive pedagogies. The current research also has implications for the broader subject of student technology adoption, as it supports Chen et al.'s (2017) extension of Davis' (1989) Technology Acceptance Model to include altruism. Additionally, it supports Kranke et al.'s (2013) conclusion that compliance is a powerful motivator of student behavior. Such results can inform research into the adoption of other formats and technologies beyond EPUB.

While this small-scale study featured only a handful of participants in an interview setting, large-scale experimental studies should be conducted so that researchers can extrapolate their findings to a more generalized student population. Additional qualitative research on this subject is also needed to expand the pool of available data on student technology preferences.

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