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THE INFLUENCE OF TECHNOLOGICAL SAVVINESS AND HOME INTERNET ACCESS ON STUDENT DECISIONS TO USE PRINT OR DIGITAL COURSE MATERIALS

Abstract

The purpose of this survey research study was to examine Tennessee community college student decisions and experiences with print and digital course material formats. Analysis considered which format students prefer between print or digital, the reasons behind those preferences, and whether those preferences significantly differed based upon demographic characteristics, perceived levels of technological savviness, and/or the availability of home internet access. Students enrolled for the fall 2019 semester at community colleges across the Tennessee Board of Regents system were surveyed using both open- and closed-ended questions (n = 1,912). Results showed that most students (63.6%) preferred to use print materials, with no significant connections based on demographic characteristics (non-White, low income, age) or home internet access. Student voices woven throughout provided an additional layer of insight for educational leaders seeking to establish policies and practices that optimize the student experience.

Keywords: college textbooks, print or digital course materials, community college student preferences, wifi access, technological savviness

The influence of technological savviness and home internet access on student decisions to use print or digital course materials [Pre-Print] © 2021 by Elizabeth Spica is licensed under CC BY 4.0

The Influence of Technological Savviness and Home Internet Access on Student Decisions to use Print or Digital Course Materials

Affordability is often considered a key to college success, yet the cost of textbooks and course materials continues to rise at an alarming rate. From 2006 to 2016, textbook costs increased 88%, even outpacing the rapid 63% increase in tuition and fees during that same time (BLS, 2016). Students unable to afford the ever-rising cost of course materials make decisions to drop and withdraw from courses, avoid courses and majors, and sometimes even attempt coursework without the required materials, leading to poor grades and delays to graduation (Florida Virtual Campus, 2019; Martin, et al., 2017; Nagle & Vitez, 2020).

Most solutions intended to mitigate issues related to the high cost of course materials center around the use of digital technologies. Digital courseware and eTextbooks, marketed for their price and convenience, have increasingly eliminated the third-party, lower cost, used materials market (Jarvis, 2019; Knox, 2019; Millward, 2019; Vogel, 2012). Publishers and digital delivery companies have also partnered to introduce *Inclusive Access* programs that automatically add course material costs to tuition, allowing students to pay with qualifying financial aid (however also effectively deferring those expenses to student loan debt). Faculty interested in eliminating course material costs altogether have turned to freely available Open Educational Resources (OER). While OER allow for unlimited printing and distribution, they are typically provided in digital form, leaving students responsible for print costs as needed.

Textbooks and course materials remain central to the academic experience, and despite the increasing proliferation of digital options, more information is needed on how students select and engage with the materials they are required to purchase. Just as institutions display interest and willingness to respond to student preferences in areas like campus infrastructure and

ancillary services, understanding decisions related to course material formats will better assist institutions in promoting options that accommodate the student consumer. To fill this gap, this study examined students' course material format preferences, with attention to underlying correlates and reasons why students prefer print or digital. By weaving student voices throughout the qualitative analysis and discussion, the student consumer was also given a platform from which to share their perspectives and experiences.

To examine student format choices through the lens of equity, data were also disaggregated by demographic characteristics to illuminate potential disparities based on race/ethnicity, income, and/or age. Format preferences were likewise examined based on students' perceived levels of technological savviness and the availability of sufficient home internet access to complete homework and other course assignments. Results are designed to empower policymakers and educational leaders to frame conversations around how course material policies and practices may perpetuate equity-related issues. These findings may also influence policies and programs that restrict format availability to either digital or print. Finally, because the customer experience plays a central role in the intelligence gathering process of market orientation – arguably even moreso in the increasingly competitive higher education landscape– the insight provided by this study will help stakeholders make decisions that optimize the customer experience and, ultimately, positively impact the performance of the institution.

College Student Attitudes and Preferences toward Print and Digital Materials

Research concerning student attitudes and preferences toward print and digital course materials has offered mixed results. Most findings, stemming from cross-sectional survey designs, have reported a majority preference for print course materials (Medley-Rath, 2018;

Millar & Schrier, 2015; Mizrachi, et al., 2018; Morris & Lambe, 2017; Sharma, 2019; Woody, et al., 2010). Kazanci (2015) examined preferences over a six-year period and found no changes in the preference for print materials for reading activities.

Other researchers, however, found that students prefer digital materials (Adeyinka, et al., 2018; Al-Qatawneh, et al., 2019). In a cross-sectional survey of undergraduate Library Information Science students across five universities, Adeyinka, et al (2018) identified a student preference for eTextbooks, with students perceiving eTextbooks to be easy to use and to enhance their learning. Another study of 880 undergraduates from Al-Qatawneh, et al. (2019) showed a high degree of usage and preference for eTextbooks. While clear preferences were expressed in these studies, other cross-sectional survey research studies evidenced no preference for print or digital either way (Al Saadi, et al., 2017; Makwanya & Oni, 2019). For example, Makwanya & Oni's (2019) survey of 200 students showed a preference for both print and digital, with students perceiving digital to be as good as print, easy to use, and sufficient for academic purposes.

Content and genre also appear to influence format preferences. One survey of 170 students at Chattanooga State Community College revealed that students more often preferred the use of eTextbooks for courses in the humanities and social sciences (management, marketing, history, English literature, sociology, etc.) and then print for STEM-oriented areas (statistics, engineering, accounting, finance, etc.; Williams, et al., 2020). Foasberg (2014) also identified contextual differences in preferences, with print preferred for academic and long-form reading and digital for shorter, non-academic reading. These findings have been reinforced by those of Mizrachi, et al. (2018), wherein 72.8% of participants demonstrated a preference for print format with readings seven pages or more in length.

Findings related to the reasons behind format preferences provide deeper context into student course material format decisions. For example, students reported preferring digital materials for cost-savings, portability, convenience, and functionalities like the ability to search, copy-paste, and quickly navigate contents (Baek & Monaghan, 2013; Broadhurst, 2017; Grissett & Huffman, 2019; Huang, 2013; Slocum-Schaffer, 2020; Soules, 2017). Other students reported preferring print materials for consistency in formatting, print's ability to help them focus and retain information, as well as for ease of reading, highlighting and notetaking (Baglione & Sullivan, 2016; Mizrachi, 2015; Sharma, 2019; Slocum-Schaffer, 2020). Students also seemed to prefer reading from printed pages due to experiences of eye strain from the use of eTextbooks (Adeyinka, et al., 2018; Al-Qatawneh, et al., 2019; Baglione & Sullivan, 2016; Jeong, 2012). Another cross-sectional survey study from Millar & Schreier (2015) evidenced that digital materials were primarily preferred because "All required course materials are in one place at all times." The primary reason for preferring print was a rather circular "I simply prefer print to digital" (Millar & Schreier, 2015, p. 176).

The format of course materials may also impact academic performance. In a systematic review and meta-analysis, Clinton (2019) compared reading between paper and screens in terms of performance, times, and/or metacognition. Using random effects models to analyze 33 experimental design, random assignment studies across 29 reports, Clinton's results indicated that reading expository texts (as opposed to narrative texts) on a screen negatively affected performance as compared to reading from paper (Clinton, 2019). No differences in performance were found for narrative texts, nor where there any significant differences for reading time. Readers also displayed better metacognition (referred to as calibration or awareness of performance) when reading from paper (Clinton, 2019). Thayer, et al., (2011) found that some

students feel print materials better facilitate their learning by providing the ability to read, conceptually map, and interact with physical materials.

Other researchers comparing outcomes have indicated no significant role for format in academic outcomes. Morris & Lambe (2017) found no statistical differences in formative assessment performance between eBooks and print. Similarly, Murray and Pérez (2011) found no significant differences in test scores between undergraduates using printed versus digital materials.

Influences on Print and Digital Preferences

Demographic Factors

Age, a characteristic often correlated with factors like time at an institution and/or previous experience with digital course materials, has been shown to influence students' preferences for print or digital course material formats (Al-Qatawneh, et al., 2019; Baek & Monaghan, 2013; Mizrachi, et al., 2018; Weisberg, 2018; Zhao, et al., 2020). Baek and Monaghan (2013) found that students over the age of 22 had more positive eTextbook experiences than younger students. Al-Qatawneh, et al., (2019) found statistically significant differences in fifth-year students' usage of eTextbooks, similar to Mizrachi, et al.'s (2018) who noted increasing percentages of students preferring eTextbooks with each year at the institution. While this increased preference for digital could have been due to the added exposure to and experience with eTextbooks, another study by Woody, et al., (2010) found no correlation between preferences for eTextbooks and number of eTextbooks previously used.

Technological Savviness

Researchers have also suggested familiarity with technology may impact student course material format preferences. Using a quantitative, experimental design, Ngafeeson and Sun (2015) surmised that a willingness to try new technology and frequency of technology use and training influenced students' acceptance of eTextbooks. Sun and Flores (2013) found that level of technological savvy directly affected students' experiences with eTextbooks, with technology veterans utilizing more features and finding eTextbooks more helpful. Woody, et al. (2010), however, found no associations with students' comfort with computers and their use and preference for eTextbooks. Similarly, Kurata, et al., (2017) found a general preference for printed media in their cross-sectional survey of 1,755 participants across a variety of ages, even despite that respondents spent 70% of their time reading digital media.

Home Internet Access

Another issue potentially impacting material format preference and the ability to maximize the benefits of digital is the availability of home internet access (Hurley & Carter, 2020). Despite an overall 11% increase in home internet use over the past decade, a persistent digital divide still exists based on income levels, age groups, and race (Remaley, 2020). The gaps between Whites and historically underrepresented groups have remained statistically significant. For example, Remaley (2020) found that African Americans and Hispanics are 7% less likely to use the internet in general. Subsequently, while internet use among households with incomes less than $25,000 experienced a 3% growth to 65% between 2017 and 2019, usage still lags far behind the 87% seen in households with incomes of $100,000 or more (Remaley, 2020).

Overall, differing and varied results from course material format preference studies present an opportunity for additional research. While students may appreciate the functionalities of digital, they may still benefit academically from the functionalities afforded by print. The

extent to which student format preferences are associated with factors like race/ethnicity, income, age, technological savviness, and the availability of home internet access likewise remain unknown. This study focuses on the Tennessee community college population, which offers a diverse demographic in terms of age, socioeconomic status, and geographical location. Exploring the influence of home internet access and technological savviness will help policymakers and higher education leaders understand the experiences and needs of students. This deeper understanding will empower them to lead conversations and approach course material policies and initiatives through the lens of equity.

Conceptual Framework

Two frameworks, equity and market orientation, served as theoretical guides for this study (Bensimon, 2005, 2012; Narver & Slater, 1990). According to the World Health Organization (WHO), equity reflects "the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically" (WHO, 2020). In the higher education context, Bensimon's work in equity has emphasized the need for stakeholders to focus on the ability of all students to achieve (Bensimon, 2005, 2012). In doing so, before solutions to equity problems can be constructed, data-based inquiries must first be conducted to demonstrate that a problem is worthy of investigation. Data-based inquiries likewise help stakeholders resist the natural inclination to assume that a problem is understood (Bensimon, 2005, 2012). Following this framework, to identify any underlying inequities, the data analyzed for this study were disaggregated by race/ethnicity, income, age, tech-savviness, and availability of home internet access.

A second framework centered around market orientation also guided this study (Narver & Slater, 1990). This complementary framework acknowledged that, while higher education policy decisions do usually focus on the best interest of the student, decisions are also made based on potential impacts to the fiscal health and performance of the institution or organization. Students comprise the largest target market of higher education, an organization that depends on profitability (or, at the very least, continued funding) for survival. The market orientation framework from Narver and Slater (1990) connected an organization's use of customer preferences to the creation of superior value that ultimately impacts that organization's performance. The creation of a customer-supportive internal environment among all employees has been linked to organization profit (Jaworski & Kohli, 1993; Narver & Slater, 1990). A market orientation in higher education would entail the creation of superior value vis-à-vis policies and practices that consider and reflect student course material format preferences.

Purpose and Significance of the Study

The purpose of this cross-sectional survey research study was to examine the course material format preferences of Tennessee community college students, with attention to demographic characteristics and potential influences like technological savviness and home internet access. College affordability could be improved by addressing course material costs, which themselves have outpaced even the alarming increases in tuition that catalyzed state-funded tuition programs like Tennessee Promise and Tennessee Hope (BLS, 2016). Finding an equitable solution to address those costs, however, requires that stakeholders understand the dynamics of the student experience. This study provides both policymakers and educational

leaders with a richer understanding of students' preferences and experiences regarding print and digital material formats.

Despite the increasingly common role played by digital course materials, little evidence exists as to which format students prefer for learning. This study filled this gap in two ways: firstly, with a quantitative examination of student preferences that disaggregated results to examine differences based on race/ethnicity, income, age, technological savviness, and home internet access. Secondly, this study provided a deeper understanding of dynamics and experiences by weaving the student voice throughout. Taken together, the results of this study offer context to benefit practical and policy-level decisions, as well as empower policymakers and educational leaders with information to make decisions that promote equitable learning environments for the students and communities they serve.

Method

This study examined students' course material format preferences and the relationship of those preferences to demographic factors such as race/ethnicity, income, age, technological savviness, and the availability of home internet access. The following research questions guided the study:

1. Which course material format – print or digital – do students prefer?
    a. What are the reasons for those preferences?
    b. Are there significant differences in preferences for traditionally underrepresented student populations (race/ethnicity, low-income, and/or non-traditional Adult Learners)?

2. Is there a relationship between format preference and technological savviness and/or home internet access?

Study Design

A nonexperimental survey research design was selected for this study, as survey research methods are useful for understanding the characteristics of a population based on sample data (Johnson & Christensen, 2020). In the case of this study, a better understanding of course material format preferences was sought, as well as of the factors influencing those preferences. Survey research provides insight about trends, attitudes, and opinions, as well as provides data in a manner that allows for testing associations among variables (Creswell & Creswell, 2018). Prior to undertaking any steps in the research, study approval was secured through the Institutional Review Board (IRB) of both the University of Tennessee and Tennessee Board of Regents (TBR). Ethical considerations included voluntary participation not associated with any class or assignment, an informed consent prior to beginning the survey, the ability for participants to skip any question, and the data being anonymized prior to analysis (Rea & Parker, 2014).

Instrument

The survey instrument from which the questions for analysis were drawn was adapted from nationally known, peer-reviewed course material affordability surveys, namely Florida Virtual Campus (2019) and Martin, et al. (2017). Florida Virtual Campus (2019) has conducted biannual textbook surveys since 2010 and is the commonly referenced course material survey model. Similarly, Martin, et al. (2017) focused on points of impact for textbook costs, including purchases foregone in order to pay for course materials. The 53-item survey was administered fall 2019 to community college students across the Tennessee Board of Regents (TBR) system.

TBR is the largest system of public higher education in Tennessee, serving nearly 120,000 students enrolled at 40 community colleges and colleges of applied technology (TBR, 2020). The survey covered student spending on required course materials; experiences related to not having required course materials; purchase behavior, decisions, and preferences related to course materials. Open-ended follow-up questions were included throughout to capture an enriched student perspective.

Because “course materials” invited a wide range of interpretation, the survey defined required course materials as “textbooks, digital access codes, software, lab manuals, etc. that your instructor requires you to purchase for the course. These materials are listed under the ‘Required Textbooks’ section of each course syllabus.” The survey also made explicit that “required course materials” did not concern supplementary or "recommended" materials that students were not required to purchase.

Measures

The dependent variable for the quantitative analysis was student format preference (print, digital, or no preference between the two). While several subtypes of digital course materials exist (eTextbooks, interactive e-texts, digital courseware, etc.), for the purposes of this study, digital materials referred generally to electronically based materials (as opposed to materials based on paper/print).

Independent variables included demographic characteristics (race/ethnicity, income/Pell-eligibility, Adult Learner status), perceived technological savviness, and home internet access. The construction of race/ethnicity followed recommendations of the U.S. Office of Management and Budget’s Standards for Maintaining, Collecting, and Presenting Federal Data on Race and

Ethnicity (2016), with respondents self-identifying into one or more of six categories (Black or African American, Hispanic or Latino, Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, White or Caucasian, Prefer Not to Respond, Other). For the analysis, these categories were collapsed into two categories (White and Non-White).

The independent variable of income (referred to also as "Pell-eligibility") focused on low-income students most likely to be eligible for federal Pell grants as determined by a self-reported annual household income of less than $36,000. The twelve survey options for reporting annual household income were collapsed into two categories: Pell-Eligible (>$36K annual household income) and Non-Pell-Eligible. Age responses were also collapsed into two categories: Adult Learners and non-Adult Learners. The Tennessee Board of Regents (TBR) system classifies "Adult Learners" as those over 25 years of age (TBR, 2020).

The independent variable of technological savviness (technology savvy, or tech-savviness) related to being "well informed about or proficient in the use of modern technology, especially computers" (Oxford Dictionary, n.d.). On the survey (see Appendix for relevant survey items), students self-reported their level of agreement with the statement "I consider myself technology savvy." The statement was followed by the definition, "You know how to navigate and use technology, and when the technology is new, it's not hard for you to learn how to use it." Response options were measured on a 7-point unanchored scale (strongly disagree, disagree, somewhat disagree, neither agree or disagree, somewhat agree, agree, strongly agree). A seven-point unanchored scale was chosen for its greater level of reliability over a scale with four or fewer points, along with its ability to allow respondents to express a neutral response (Johnson & Christensen, 2020).

Since the use of digital technologies for homework and course assignments requires internet access beyond that which is available on-campus, availability of internet access was also included as an independent variable. The availability of internet access was measured by a Yes/No response to the question "Is your internet access at home sufficient to complete homework and other course-related assignments?" Finally, open-ended responses were included to complement the quantitative data and capture a richer perspective of the student experience. Table 1 displays variables, research questions, and corresponding survey item(s) for this study.

Table 1

Variables, Research Questions, and Survey Items

Variable	Research Question	Survey Item
Dependent Variable: Format Preference	Which course material format – print or digital – do students prefer?	Do you prefer your course materials to be in digital or print format? 1. I prefer digital course materials. 2. I prefer print course materials. 3. I have no preference -- I feel the same way about digital and print.
Independent Variable 1: Technological Savviness	Is there a relationship between format preference and technological savviness and/or home internet access?	Please state your level of agreement with this statement: I consider myself technology savvy. ("Technology savvy" means you know how to navigate and use technology, and that when the technology is new, it's not hard for you to learn how to use it.) Strongly Disagree Disagree Somewhat Disagree Neither Agree nor Disagree Somewhat Agree Agree Strongly Agree
Independent Variable 2: Home Internet Access	Is there a relationship between format preference and technological savviness and/or home internet access?	Is your internet access at home sufficient to complete homework and other course-related assignments? Yes No

Participants

The population for this study included all students enrolled for the fall 2019 semester at community colleges across the Tennessee Board of Regents system (N = 88,946). TBR houses Tennessee's two-year public institutions, including 13 community colleges offering classes in almost all 95 counties within the state. The fall 2019 student population consisted of 70.7% White, 15.9% Black, 6.4% Hispanic, and 7.0% Other (TBR Data, 2020). Over half were female (61.1%), 38.9% were male, and 28% were over the age of 25. Over a quarter (37%) received some form of Pell grant assistance, and approximately half (50.5%) attended part-time. High school students participating in dual-enrollment programs were not included in the study.

Data Collection

This study employed a census survey approach to data collection. To maintain the security of student contact information, surveys were distributed via email by institutional research directors on each campus to all enrolled students.

Procedure

After securing approval from both The University of Tennessee, Knoxville, and Tennessee Board of Regents Institutional Review Boards, research directors at each community college were given two weeks to provide feedback on the survey design. After this feedback period, the survey was pilot tested on desktop, laptop, and mobile devices with both research directors and individuals representing a range of ages and college experience (Johnson & Christenson, 2020).

The survey was administered via email invitation sent by research directors at each participating community college campus beginning the 8th week of the fall 2019 semester. The

8th week of the semester was selected as a time when students would still have been likely to recall how much they spent on materials while also having enough of the semester underway to determine whether faculty were incorporating those materials into the course. Campuses were also given the choice to deploy an additional survey notice within their password-protected campus portal. The pre-screening and informed consent comprised the first page of the survey, and once completed, students were able to progress to the survey.

The survey remained open for two weeks, with a first reminder sent after nine days and a final reminder two days before the survey close. To encourage participation, research directors sent an email to instructors at the halfway point requesting they remind (but not incentivize) students to read the email invitation and consider completing the survey. The complete survey timeline is indicated below:

- Day 1 – Survey Launch / Email Invitation to Students
- Day 7 – Email from Research Directors to Instructors
- Day 9 – Email Reminder 1
- Day 12 – Email Final Reminder
- Day 14 – Survey Close

Analyses

Both quantitative and qualitative data were analyzed using SPSS (Version 26) and nVivo (Version 12), respectively. For the quantitative analysis, data were first cleaned using Morrow's (2017) twelve-step process. Data were then imported into SPSS (Version 26) and prepared by correcting coding errors, assessing for normality, dealing with outliers and missing data, and modifying variables for analysis. For example, the Likert scale reporting technological savviness was recoded to better compare the preferences of those who consider themselves savvy vs. not,

with respondents reporting somewhat to strong disagreement with the statement categorized as "Not Tech Savvy" (n = 294) and respondents somewhat to strongly disagreeing with the statement classified as "Tech Savvy" (n = 1,462). Respondents who neither agreed nor disagreed with the statement (n = 152) were excluded from analysis.

The next step of analysis, descriptive statistics, showcased the sample characteristics (Morrow, 2017). The final step of analysis, a multinomial logistic regression, determined the extent to which format preferences could be predicted by students' self-reported level of technological savviness and home internet access. Multinomial logistic regression was selected for its ability to predict the values of a nominal dependent variable with three categories based on the value of one or more independent variables (Johnson & Christensen, 2020). In this study, the dependent variable was format preference (preference for digital or preference for print, with no preference as the reference category). The three independent variables were 1) demographic characteristics (race/ethnicity, income, age), 2) technological savviness and 3) availability of home internet access.

Qualitative data were analyzed in two steps. First, the open-ended survey responses were uploaded into nVivo coding software (Version 12). The individual responses were then analyzed using a thematic coding process, beginning with open coding in which segments of meaningful data were identified (Merriam & Tisdell, 2016). Since a single case could have received multiple coding references, the number of codes exceeded the total number of cases. After open coding, axial coding was conducted to group the open codes into categories based upon the identification of collections of similar codes; then, from those categories, key themes were assigned (Morse, 2010). To ensure validity and reliability of the findings, an external expert in qualitative methods confirmed the coding and analysis procedures.

Results

This study examined community college student course material format preferences and whether race/ethnicity, income, age, level of technological savvy, and availability of home internet access could serve as predictors of those preferences. Prior to analysis, assumptions were checked to confirm 1) the dependent variable was measured at the nominal level, 2) one or more independent dichotomous variables were included, 3) no outliers were present; 4) categories were independent, and finally 5) the coefficient's output for all variables returned VIF values slightly greater than 1, indicating no multicollinearity issues (race/ethnicity, Tolerance = 0.985, VIF = 1.015; income/Pell-eligibility, Tolerance = 0.969, VIF = 1.032; age/Adult Learner status, Tolerance = 0.996, VIF = 1.004; tech-savviness, Tolerance = 0.988, VIF =1.012; home internet access, Tolerance = 0.982, VIF =1.019; Laerd Statistics, 2020).

Univariate Analyses

A univariate analysis was first performed to showcase the demographic characteristics of the 1,912 responses included in the study. Table 2 displays the basic descriptive statistics of the sample population.

Table 2

*Demographic Characteristics of the Sample (*n = *1,912)*

Demographic Characteristic	*N*	% of Total
Gender		
Female	1,455	76.4%
Male	413	21.7%
Non-binary/Third Gender	11	0.6%
Total	1,905	
Race/Ethnicity		
White	1,528	83.3%
Black	103	5.6%

Hispanic	113	6.2%
Asian	27	1.5%
Other	63	3.4%
Total	1,834	
Income / Pell-Eligibility		
Annual Income below $36K	690	47.4%
Annual Income above $36K	765	52.6%
Total	1,455	
Adult Learner Status		
Adult Learners Over Age 25	898	47.7%
Learners Under Age 25	985	52.3%
Total	1,883	

Note. Number of responses differ, as participants were able to skip questions.

Research Question 1. *Which course material format – print or digital – do students prefer?*

Students were asked to report their preferred course material format: print, digital, or no preference between the two. Of the 1,908 who responded to the question, over half (63.6%) preferred course materials in print format and 10.1% preferred digital format materials. Slightly over a quarter of students (26.3%) expressed no preference between print or digital.

Research Question 1, Sub-Question A. *What are the reasons for those preferences?*

Students who reported preferring either print or digital were then asked to share the reason(s) for their preference. Of the 1,304 (92.7%) respondents to this follow-up question, 1,127 (86.4%) had expressed a preference for print and 177 (13.6%) had expressed a preference for digital. See Table 3 for overall themes and categories that emerged from the data.

Table 3

Overall Themes: Course Material Preferences (1,304 cases)

Theme	Categories	# Codes	% Total Codes

Tech Issues	internet access, health risks, reliability, power required, load times, tech not allowed in class, logins and access, compatibility, ads, general tech issues	621	22.8%
Learning	reading, retaining, studying, focus, learning styles, disability, homework	594	21.8%
Physicality	hands-on, physical copies, physical interaction, paper, real book, hard copy	354	14.4%
Navigation	reference, pages, flip, searching, navigate, format	332	13.0%
Annotation	notes, highlight	302	11.1%
Convenience	General convenience, print convenience, availability, anytime, homework, less chance of losing, forgetting, or damaging, efficiency, time management	171	6.3%
Portability	anywhere, easier to carry, bulky, heavy	135	5.0%
Costs	explicit costs, hidden costs (additional tech and equipment required, environment, specific tech to learn)	71	2.6%
Inertia	age, "used to", old-fashioned	68	2.5%
Retain	want or need to keep, resale	51	1.9%
Unspecified	*(restated preference with no further info or justification)*	20	0.7%

Why Students Prefer Print Course Materials. To better understand each format preference, responses for those who preferred print (n = 1,127) were then coded separately from responses for those who preferred digital (n = 177). Table 4 illustrates the most prominent themes emerging from the reasons for preferring print.

Table 4

Top Themes: Preferences for Print (1,127 cases, 2,210 total references)

Theme	Categories	# (%) Coding References
Learning	reading, retaining, studying, focus, learning styles, disability, homework	480 (21.7%)
Tech Issues	internet access, health risks, reliability, power required, load times, tech not allowed in class, logins and access, compatibility, ads, general tech issues	472 (21.4%)
Physicality	haptics, spatial relations, paper, "real book", hard copy	332 (15.0%)
Navigation	reference, pages, flip, searching, navigate, format	301 (13.6%)
Annotation	notes, highlight	286 (12.9%)

Print Theme 1: Learning. Learning, or the advantages afforded by print for activities like reading, studying, focusing, and retaining information, was the most prominent theme for students who preferred print materials. Students reported that print helps them more easily learn and retain information. As one student related, "I learn best when I can physically interact with things. Manually turning the pages and highlighting parts of the book are much more effective for me." Others mentioned how print's relative lack of distraction helps them focus. For example, one student noted, "I cannot concentrate when reading online books. I always get distracted by other things online." Also frequently mentioned was the helpfulness of having print materials available while working on a computer to complete homework and other assignments.

Print Theme 2: Tech Issues. The second most prominent reason reported for preferring print almost solely related to an aversion to digital because of technical issues experienced. Tech issues ranged from the need for internet connectivity and additional equipment (laptops, electronic devices, etc.), to health issues due to time "staring at a screen." One response captured the general sentiment: "… something other than being on a computer at work all day, just to come home and total a day of being on a screen for 14 hours. It gives me terrible headaches and makes my eyes feel irritated." The reliability of print relative to digital was also commonly indicated, as print materials do not rely on having power, a charged device, internet access, or functioning websites.

Print Theme 3: Physicality. A third theme was physicality, or print's ability to provide interaction with the physical environment. This category included references to print as "real" or "actual" books and suggested benefits from "hands-on" haptic and other sensory interactions from having materials "in front of me." Typical responses for this category included the following: "I can focus better when I can touch and hold the text." Also: "I prefer to hold my

textbook as to having it digitally, because I feel it helps me to be able to keep up and understand it."

Additional Print Themes. Additional themes included navigation (how one maneuvers through) and annotation (the ways in which one interacts). These comments, while closely related to those of the physicality theme, spoke more directly to the functions available with the materials themselves:

> "With textbooks, I need to be able to easily flip back and forth to look at definitions, images, and flowcharts related to the chapter. Each chapter refers to multiple images that are far easier to view in a print textbook as I read to understand the materials. Electronic book readers don't have a large enough viewing window to do this."

Several respondents referred to the inconvenience of having to learn multiple new systems for highlighting and note-taking. For example, one student remarked, "Print textbooks are also easier to mark up with highlighting and post it notes, eTextbooks require strange highlighting methods that are annoying to try and figure out."

Why Students Prefer Digital Course Materials. Students' open-ended responses for preferring digital materials were also coded (n = 177). See Table 5 for the most prominent themes that emerged from analysis.

Table 5

Top Themes: Preferences for Digital (177 cases, 251 coding references)

Theme	Categories	# (%) Coding References
Portability	anywhere, bulky, easier to carry, heavy	79 (31.5%)

Convenience	anytime, availability, general convenience, homework, less chance of losing, forgetting, or damaging, print convenience, time management	47 (18.7%)
Learning	disability, focus, homework, learning styles, reading, retaining, studying	28 (11.2%)
Navigation	flip, format, navigate, pages, reference, searching	24 (9.6%)
Costs	explicit costs, hidden costs	22 (8.8%)

Digital Theme 1: Portability. Portability was the most prevalent theme for over a quarter of students (31.5%) who expressed a preference for digital materials. Portability encompassed dealing with the weight and bulk associated with physical textbooks, and the relief from not having to "lug around a computer and a textbook to classes." As one student remarked, digital materials are "easier and less stress on the body than carrying a backpack loaded with books." The portability of digital materials also more easily allows for impromptu studying, as one student noted, "If I find I have time at work or while I'm out and about, I can whip out my phone or tablet and study a little on the go without lugging bulky books."

Digital Theme 2: Convenience. Convenience was the second major theme for students who preferred digital materials. Digital materials enable multiple resources to be housed on a single electronic device. Furthermore, because devices like smartphones are usually always with the student, they are less likely to lose or "forget them at home." The "anytime, anywhere" ability of digital also enables access from any public or private electronic device. As one student noted, "My saved notes and assignments on my laptop can be opened on a public computer, my own desktop, and my phone." A few students commented how features like calendars and push notifications have enabled them to better manage their time and maintain oversight of class activities.

Digital Theme 3: Learning. Learning also appeared as a prominent theme for students preferring digital. Students with disabilities remarked on the benefits of technology to magnify,

annotate, and read the text aloud. One respondent remarked, “Since I'm legally blind I have a lot more ways to navigate the material (magnification, screen readers, etc.).” Others noted that digital materials provide a more efficient study experience than print, citing additional study aids and/or digital materials that allowed for easy copy/pasting of text into study guides.

Additional Digital Themes. Navigation and cost were the fourth and fifth most prominent themes. For students preferring digital, navigation comments primarily centered on the relative ease of searching for information: “I find that digital course materials allow you to search faster and easier.” Cost comments related to digital materials’ being “usually cheaper.” They also encompassed remarks of the relative environmental friendliness of digital materials, such as “saves resources, trees, energy, etc.”

Research Question 1, Sub-Question B. *Are there significant differences in preferences for traditionally underrepresented student populations (race/ethnicity, low income, and/or non-traditional Adult Learners)?*

A multinomial logistic regression was performed to see whether student format preferences could be predicted based on demographic characteristics race/ethnicity (White or non-White), income (above or below $36K annual household income), or non-traditional Adult Learner status (under or over the age of 25). After confirming model fit as indicated by the Goodness-of-Fit Test χ^2 (6) = 4.263, p = 0.641, the multinomial regression was conducted.

Results of the multinomial regression found no significant differences in preference for print or digital based on non-White racial/ethnic status χ^2 (1, N = 1,410) = 0.641, p = 0.726, income χ^2 (1, N = 1,410) = 2.464, p = 0.292, or Adult Learner status χ^2 (1, N = 1,410) = 1.356, p = 0.508. Results of the regression are exhibited in Table 6.

Table 6

Multinomial Regression Results: Preferences by Demographic Characteristic

Parameter[a]	*B*	Exp (*B*)	Std. Error	95% Confidence Interval for Exp(B)		Hypothesis Test		
				Lower	Upper	Wald Chi-Square	df	Sig.
Print Preference (Intercept)	.987		.110			79.767	1	.000
Non-White	.106	1.112	.173	.793	1.559	.376	1	.540
White	0[b]						0	
Pell-Eligible (>$36K Income)	-.150	.861	.123	.676	1.097	1.470	1	.225
Not Eligible (<$36K Income)	0[b]						0	
Adult Learners (Age 25+)	-.139	.870	.123	.683	1.108	1.273	1	.259
Non-Adult Learner (Under 25)	0[b]						0	
Digital Preference (Intercept)	-.891		.176			25.480	1	.000
Non-White	.200	1.222	.273	.716	2.085	.541	1	.462
White	0[b]						0	
Pell-Eligible (>$36K Income)	-.286	.751	.202	.505	1.116	2.011	1	.156
Not Eligible (<$36K Income)	0[b]						0	
Adult Learners (Age 25+)	-.047	.954	.201	.644	1.414	.054	1	.816
Non-Adult Learner (Under 25)	0[b]							

Dependent Variable: Format Preference: Print, Digital, or No Preference
Reference Categories: White, Annual Household Income <$36K, Under Age 25
a. Reference Category = No Format Preference
b. Set to zero because parameter is redundant.

Research Question 2. *Is there a relationship between format preference and technological savviness and/or home internet access?*

A second multinomial regression was conducted to explore whether format preferences could be predicted based on whether students considered themselves to be technologically savvy. The chi-square likelihood ratio indicated a good model fit χ^2 (2) = 3.82, p = 0.148. Results of the regression indicated no significant associations in preferences for print based on level of technological savviness χ^2 (1, N = 1,752) = 0.97, p = 0.325. A significant association in preference for digital was found, with students who did not consider themselves technologically

savvy to be 1.6 times more likely to prefer digital materials χ^2 (1, N = 1,752) = 3.93, p = 0.047. No significant associations were found between technological savviness and preference for print. Closer examination revealed close percentages of non-tech savvy and tech-savvy within each preference group. Of those 167 who preferred digital, 22% (n = 36) considered themselves non-tech savvy; of the 1,108 students preferring print, 17% (n = 187) considered themselves non-tech savvy. Table 7 displays results of the multinomial regression analysis.

Table 7

Multinomial Regression Results: Preferences by Technological Savviness

Parameter[a]	*B*	Exp (*B*)	Std. Error	95% Confidence Interval for Exp(*B*)		Hypothesis Test		
				Lower	Upper	Wald Chi-Square	df	Sig.
Print Preference (Intercept)	.968		.139			48.263	1	.000
Not Tech Savvy	-.149	.861	.152	.640	1.159	0.970	1	.325
Tech Savvy	0[b]						0	
Digital Preference (Intercept)	-.679		.205			11.018	1	.001
Not Tech Savvy	-.452	.636	.228	.407	.995	3.932	1	.047*
Tech Savvy	0[b]						0	

Dependent Variable: Format Preference: Print, Digital, or No Preference
a. Reference Category = No Format Preference for either Print or Digital
b. Set to zero because parameter is redundant.

A third multinomial regression was used to determine whether student format preferences could be predicted based on the availability of home internet access. Results demonstrated no significant differences in preference based on home internet access χ^2 (2, N = 1,899) = 4.160, p = 0.125. Table 8 displays the multinomial regression results.

Table 8

Multinomial Regression Results: Preferences by Home Internet Access

Parameter[a]	B	Exp (*B*)	Std. Error	95% Confidence Interval for Exp(*B*)		Hypothesis Test		
				Lower	Upper	Wald Chi-Square	df	Sig.
Print Preference (Intercept)	.850		.056			232.386	1	.000
Insufficient Home Internet	.303	1.353	.186	.941	1.947	2.659	1	.103
Sufficient Home Internet	0[b]						0	
Digital Preference (Intercept)	-1.017		.091			126.106	1	.000
Insufficient Home Internet	.498	1.646	.268	.973	2.785	3.448	1	.063
Sufficient Home Internet	0[b]						0	

Dependent Variable: Format Preference: Print, Digital, or No Preference
a. Reference Category = No Format Preference
b. Set to zero because parameter is redundant.

Discussion

Educational leaders seeking to increase college affordability through policies that help lower the cost of course materials will benefit from a richer understanding of student experiences with print and digital formats. This study sought not only to uncover student preferences and experiences, but also how they connect with demographic characteristics and factors like internet access and technological savviness. Disparities in any of these factors have the potential to impact the ability of community colleges to provide equitable learning environments for the citizens and communities they serve.

Format Preferences and Influences

The univariate analysis first investigated the course material format choices of Tennessee community college students, with results indicating a clear preference for print course materials (63.6% print, 10.1% digital, and 26.3% no preference). These findings are largely consistent with

those of several studies indicating that students prefer print materials (Millar & Schrier, 2015; Mizrachi, et al., 2018; Morris & Lambe, 2017; Sharma, 2019; Woody, et al., 2010). In the present study, the primary reasons students reported preferring print were related to perceived benefits to learning and tech issues related to digital materials. Issues reported, ranging from a lack of internet access to difficulties navigating eTextbooks and the additional costs of e-readers, were also echoed in Adeyinka, et al., (2018). For students who preferred digital materials, portability and convenience were the most frequently reported reasons.

Following the univariate analysis, multivariate analyses explored correlates to students' preferences in order to uncover disparities that might impact equitable learning. Results indicated that student format preferences could not be predicted by race/ethnicity, income, age, or the availability of home internet access. While preferences for print could not be predicted based on technological savviness, preferences for digital were significantly associated with students who did not consider themselves to be technologically savvy (albeit barely so, $p = 0.047$). These findings reinforce those of Kurata, et al. (2017), which indicated a mismatch between preferences and actual behavior, as well as those of Woody, et al. (2010), which found no significant correlation between number of e-books previously used and overall format preference.

Reasons for Student Preferences

Hallmark to this study were the open-ended data, which offered student voices to provide educational leaders with a richer understanding of the student experience with print and digital formats. Perceived benefits to learning, tech issues, and physicality were students' primary reasons for preferring print. These findings substantiate perceptions that printed materials better facilitate learning, focus, and retention of information (Mizrachi, et al., 2018), especially for the

expository nature of academic textbook content (Clinton, 2019). Clinton (2019) suggested that readers may be better aware of their performance when reading from paper, with the physical aspects of print potentially cueing deeper processing and learning. This deeper processing stands in contrast to the more leisure-oriented, superficial processing approach associated with reading from a screen (van den Broek, et al., 2001).

In contrast to perceived learning benefits, this study found students preferring digital materials for their convenience and portability moreso than their price. This was a surprise given the emphasis of cost-savings as a reason to opt for digital, and a divergence from the findings of Baglione & Tapia (2016) who noted price as the most important attribute for students selecting between traditional print and eTextbooks. This discrepancy may be explained by an examination of relative price differences between digital and printed materials. For example, Amazon's Chegg service shows pricing for the most recent edition of a principles of marketing textbook to differ from a $59.99 6-month digital rental to a $91.99 5-month print rental (Chegg, 2021). A used printed copy could be purchased for only $10 more than the print rental ($101.99), or a new printed copy acquired for $268.49. The purchase of a digital option was unavailable at the time of investigation (via Chegg or any other purchase channel, including the publisher). When examined from this cost perspective, it is understandable that "cost savings" may play a lesser role in student preferences over attributes like convenience and portability.

Despite the prominence of convenience as a reason for preferring digital, comments suggested that the actual convenience occurs mostly outside the classroom, at least for students in the study population. Several comments related instances where instructors required digital materials but then restricted or prohibited the use of technology in the classroom. One student summarized the issue:

> "I also had classes where classmates bought digital copies of required textbooks and the professor would not allow that student to have their phone, tablet, laptop or any other form of technology out, which prevented the student from using this copy and receiving low grades on their course work. As a result of all of these situations, I decided that a digital copy causes too many problems for me to think about buying them."

This "no electronic devices in class" policy may have stemmed from a time where electronic devices did not play such a prominent role in learning. This policy is a prime example of an institutional practice worthy of examination for its potential impacts on equitable learning. If eTextbooks are increasingly the norm, in some cases made the sole format available for accessing content through digital distribution models like *Inclusive Access*, these types of classroom-level restrictions are certainly in need of revisiting.

Function

Function also seems to influence preference, especially the extent to which students need to retain materials beyond the duration of the course. As one student in the present study remarked, "It actually depends... some courses I like to have a textbook to keep for reference in my job, but most I prefer the digital copy for convenience." One way to easily resolve this conflict would be through the use of openly-licensed, freely and permanently available OER. Aside from being free to the student, these materials (usually digital in form and freely available on the internet) would easily accommodate the 61.7% of students who prefer to keep a printed copy of course readings (Medley-Rath, 2018). With OER, students decide which materials they wish to retain (in PDF format, on a hard drive, or printed and bound), and OER's adaptable nature means instructors are able tailor those contents to suit their specific learning outcomes.

Policy Recommendations

In an ideal, market-oriented environment, students would be able to enjoy the convenience and portability of digital alongside the learning advantages they identify with print. To this effect, publishers and programmers alike may invest in development that further tends to the physical and environmental cues that assist memory and retrieval (see Nichols, 2020, and Spencer, et al., 2020 for recommendations). For example, most devices and apps include progress bars, but shifting pixels on a screen may not provide the physical magnitude of change required for the totality of senses to maneuver information into long-term storage.

In the meantime, faculty may benefit student learning by assessing the function of their course content and tailoring formats as per that content's intended purpose. Where retention is vital but only digital materials available, faculty could distill important information into study guides suitable for printing and studying. In cases where time is limited, faculty could facilitate a collaborative activity to promote exposure to important content wherein students draft guides, then exchange and improve them with peers. Making key course content available in printed form may promote better learning by eliminating the mind-wandering and other distractions associated with reading from screens (Clinton, 2019). As one student in this study related, "On a computer there are many things I would rather do than complete my reading, so I normally don't finish the chapter."

This study has demonstrated that students perceive print materials to be important to learning. Aspects like cost may be considered key in furthering the expansion of digital textbook use (Hancock, et al., 2016), but relative savings may be negligible if students need to purchase an additional print copy for the benefit of their learning. Where digital materials are the only option, faculty may suggest ways to maximize the use of navigation signals like progress bars that most

closely approximate the physical cues of print. When introducing required materials on the first day of class, instructors can orient students to the highlighting and note-taking features of digital texts, while also encouraging focused reading by making students aware of strategies to circumvent potential issues caused by electronic distractions (Brun-Mercer (2019) and Nichols (2020) provide suggestions to improve performance with on-screen readers).

Beyond classroom usage, educational leaders seeking to protect the student consumer should consider the cost of electronic devices and print add-ons as part of the bottom-line price when evaluating course material initiatives. If initiatives are pursued solely on account of cost-savings, the cost of the electronic devices required to access digital materials, as well as the printed add-ons that students regard so necessary to their learning, should each be factored in. Savings that do not add up may necessitate a new approach.

Findings from this study suggest that print materials play a continued role in learning, while also revealing that students' preferences for print seem to be largely driven by issues with technology. Specifically, students reported that the use of digital materials require the additional purchase of suitable electronic devices, internet access, and more time "staring at a screen." While increased screen time may be an unavoidable consequence of an increasingly digital world, issues related to electronic devices and internet access could be addressed through policy. Adeyinka, et al., (2018) suggested that institutions make eBook readers more readily available to students, and electronic device loan programs are becoming increasingly commonplace to serve students who may be negatively affected by not owning a laptop (Riesdorf, 2020). The lack of internet access and greater need for online learning give institutions of higher education a powerful argument to advocate for state and federal broadband initiatives that would close the "homework gap" while also expanding the ability to serve citizens in rural areas (Rachfal, 2020).

With these impediments resolved, students may be more accepting of and likely to gravitate toward digital materials.

Limitations

While all Tennessee community college students have access to campus Wi-Fi and institutional email, the web-based survey research method utilized in this study limited participation to populations with access to e-mail and a computer. Those uncomfortable with web-based technology may have been more likely to exclude themselves from participation (Rea & Parker, 2014). Since survey research also relies upon self-reported data, results may not have completely represented an accurate reality. Similarly, because participants could skip questions, data were missing that could have impacted analysis. For instance, only 75% responded to the income question, revealing that many students – younger ones especially—may be unaware of their annual household income. Future studies may consider designs that collect income data outside of that which is self-reported. Despite these limitations, a survey research design was most appropriate for the pragmatic approach of this project to capture student perspectives and enable a deeper understanding for those making decisions related to course material costs. This survey's cross-sectional design, while immediately limited in scope, will nonetheless prove helpful as a baseline toward longitudinal measures of progress and changes in student attitudes over time.

Conclusion

As digital course materials become increasingly the norm in higher education classrooms (NACS, 2020), this study offers a more complex understanding of student format preferences and experiences. The majority preference for printed course materials uncovered by this study

(63.6%), along with the learning benefits students perceived printed materials to provide, offer evidence that print retains an important place in student learning. As higher education systems seek to retain and grow enrollments, the question is not necessarily “Digital or print?” but rather “When digital? When print?” Function, context, and use matter, each of which can be enhanced to improve the student experience— faculty can consider which use cases necessitate print, institutions and states can pursue partnerships that resolve tech issues hindering digital usage, and publishers can continue improving digital products to realize the same benefits that students currently associate with print.

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Appendix: Relevant Survey Items

Do you prefer your course materials to be in digital or print format?

I prefer digital course materials.
I prefer print course materials.
I have no preference -- I feel the same way about digital and print.

(Responses "I prefer digital course materials" and "I prefer print course materials" receive the follow-up question: "Please briefly share why you feel this way:")

Please state your level of agreement with this statement: I consider myself technology savvy. ("Technology savvy" means you know how to navigate and use technology, and that when the technology is new, it's not hard for you to learn how to use it.)

Strongly Disagree
Disagree
Somewhat Disagree
Neither Agree nor Disagree
Somewhat Agree
Agree
Strongly Agree

Is your internet access at home sufficient to complete homework and other course-related assignments?

Yes
No

Are you studying full-time or part-time this semester?

Full Time (9+ credit hours)
Part Time (fewer than 9 credit hours)

Which best describes your gender identity?

Woman
Man
Non-binary/third gender
I prefer not to respond

What is your age?

Less than 18 years old
18-24 years old
25-34 years old
35-44 years old
45+ years old
Prefer Not to Respond

Which of the following categories best describes your race and/or ethnicity? Select one or

more:

Black or African American
Hispanic or Latino
Asian
American Indian or Alaska Native
Native Hawaiian or other Pacific Islander
White or Caucasian
Prefer Not to Respond
Other (please specify) _____

Please estimate your annual household income. Household income = the combined amount all the adult members of your household (that you've identified above) earn each year.

Less than $13,000
$13,001-$16,999
$17,000-$19,999
$20,000-$24,999
$25,000-$31,999
$32,000-$35,999
$36,000-$46,999
$47,000-$55,000
$55,000-$64,999
$65,000-$74,999
$75,000-$99,999
$100,000 or more
Not sure
Prefer not to answer