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INFORMATION SYSTEMS EDUCATION JOURNAL

Editors

Are Tech Savvy Students Tech Literate? Digital and Data Literacy Skills of First-Year College Students

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Abstract

Much has been written on the skills and capabilities of a new generation raised with social media, smartphones, and immediate access to data and information via the Internet. Today's college students grew up using the Internet, where they both generate and consume data. But do incoming college students have the skills necessary to thrive in a digital world that requires the ability to generate, analyze, and share insights from data? This paper presents a study, performed at two small New England institutions each with a business focus, which examines the digital skill sets of first-year college students in relation to the skills they have developed before entering college. The authors also consider whether there is a "digital divide" among first-year college students in relation to their previous technology skills. When applying the Databilities framework for evaluating data literacy competencies, results show that teaching data literacy skills to first-year college students will be critical to their academic success as future information technology workers.

Keywords: Data Literacy, Digital Literacy, Digital Skills, Digital Native, First-Year College Students.

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Are Tech Savvy Students Tech Literate? Digital and Data Literacy Skills of First-Year College Students

Kevin Mentzer, Mark Frydenberg and Adam Patterson

1. INTRODUCTION

Students today are adept at using mobile devices to manage their lives, but often lack the skills to generate, evaluate, and share the data that they interact with professionally or informally every day.(McCarron & Frydenberg, 2023; Tugend, 2023) This study, performed at two small New England institutions each with a business focus, aims to evaluate the digital and data literacy skills of incoming college students, and ascertain which skills they find critical to their success academically and as future information technology workers. Employers need data-literate employees who can interact with data at all stages throughout a project. Today's job market requires proficiency in gathering and collecting data, managing and processing data from multiple sources, analyzing data to identify patterns and trends, and communicating these insights through visualization tools to inform stakeholders in their decision-making process (Leon-Urrutia et al., 2022). As the demand for technology professionals who possess basic data literacy skills continues to increase (Hartzel & Ozturk, 2022), for the availability of increased instruction in these areas will prepare students for lucrative future careers as information workers and knowledge professionals in fields relying on data-driven decision-making skills.

A survey of 432 college students conducted in 2023 by the Chronicle of Higher Education (Tugend, 2023) found that 52% of those surveyed self-identified as "highly proficient", 45% as "somewhat proficient", and 3% as "somewhat deficient" when asked to rate their proficiency with digital technology and digital skills. These students, whom Prensky (2001) coined digital natives because they grew up in an era where devices and technology were ubiquitous, assessed their overall digital proficiency in terms of awareness, comprehension, and user experience. Many attributed their technology proficiency to high school experiences that require the use of productivity tools (writing articles for the school newspaper, designing the yearbook, maintaining budgets, etc.)

While many college students claim to adeptly use technology in their free time for personal and social purposes, the Chronicle study concludes that they often do not have the skills to make sense of the information and data that they create and interact with regularly.

2. FRAMEWORKS FOR EVALUATING DIGITAL AND DATA LITERACY

Digital literacy refers to the ability to use digital technologies for communication, locating information online, navigating an operating system, and other computer literacy tasks (McCarron & Frydenberg, 2023). Achieving data literacy requires the digital literacy skills necessary to obtain and interact with large sets of data, the critical thinking skills required to evaluate and make sense of it, and the communication skills needed to share insights to inform decision making in a business context. Students also need to know why and when to use those skills along with how to select the appropriate data to be used (Frank et al., 2016; Leon-Urrutia et al., 2022).

"Digital intelligence" (DQ) is an emerging umbrella term that includes both digital and data skills, competencies, readiness, and literacy (IEEE, 2021). The IEEE's DQ Framework identifies twenty-four competencies including personal and social identities in digital spaces, use of devices and digital media, personal and professional online communication and collaboration, skills for navigating digital life and careers, safety and security concerns, emotional and relational impacts of technology, and upholding human rights in a technology-enabled world(IEEE, 2021, p. 14).

The IEEE Digital Intelligence Quotient provides a framework for classifying digital skills and assessing competencies required in a world driven by technology and developing these skills to further digital intelligence. Students must think creatively and possess the digital skills necessary to succeed in the workplace. Digital literacy includes the technical skills necessary to

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
At this level of competency, an individual can complete **simple tasks *with instruction.***	At this level of competency, an individual can complete **simple tasks *on their own, with guidance where needed.***	At this level of competency, an individual can complete **well defined tasks *on their own.***	At this level of competency, an individual can complete **well defined problems and tasks *on their own.***	At this level of competency, an individual can ***assist others*** to complete **simple tasks and problems.**	At this level of competency, an individual can ***teach and assist*** others to complete **complex problems and tasks.**
Activities to support this level of competency should focus on **remembering**.	Activities to support this level of competency should focus on **remembering**.	Activities to support this level of competency should focus on **understanding**.	Activities to support this level of competency should focus on **understanding**.	Activities to support this level of competency should focus on **applying skills.**	Activities to support this leve of competency should focus on **applying skills.**

Figure 1. Levels in the Databilities Framework, adapted from (Data to the People, 2018)

participate responsibly in a technology-driven society. Digital literacy combines technical, procedural, cognitive and emotional-social skills, for example, creating a document or spreadsheet involves technical skills (knowing how to use an office productivity tool to accomplish a task), procedural skills (opening, locating, and saving documents in an operating system), and cognitive skills (navigating menus and visual cues in a user interface) (Aviram, Aharon & Eshet-Alkalai, Yoram, 2006, p. 1).

IEEE's DQ Framework identifies data literacy as one of the competencies necessary to foster competitiveness in the digital economy through solving global challenges. IEEE defines data literacy as "finding, reading, evaluating, synthesizing, creating, adapting and sharing information, media and technology"(IEEE, 2021, p. 15) Similarly, "data literacy is our ability to read, write and comprehend data. More than that, it's the ability to derive meaningful and useful information from data and apply this to create better products, services, and experiences" (Crofts, 2022).

While the IEEE DQ Framework encompasses a wider range of digital and data literacy skills, the Databilities framework (Data to the People, 2022) focuses on developing and measuring specific skills and knowledge required for interacting with and making decision informed by data. It includes four components: data awareness, data analysis, data interpretation, and data ethics.

The Databilities framework assesses fifteen core competencies across the dimensions of reading, writing, and comprehension to assess individual data literacy competencies. Databilities defines data literacy as the "ability to read, write, and comprehend" data with different levels of guidance, ranging from accomplishing simple tasks with instruction or guidance, to individually, and being able to assist or teach others how to perform tasks and solve problems of varying difficulty. Figure 1 describes the different levels of competency in the Databilities Framework.

3. METHODOLOGY

This descriptive research study aims to better understand the digital literacy skills and higher-level data literacy competencies of incoming first-year college students at two different New England institutions which have a business focus. This study extends the work of McCarron and Frydenberg (2023) which focused on digital skills of first-year students, and limiting this study to first-year students provides insights into the data and digital literacy skills they have upon entering college. The paper analyzes students' digital and data skills given a self-assessment of student's tech savviness, as presented in Figure 2. The authors define tech savviness as the extent to which one is informed or proficient about the use of digital technologies and devices.

	Skills	Tech Savvy
Digital Literacy	RQ1a	RQ1b
Data Literacy	RQ2a	RQ2b

Figure 2. Factors guiding research questions

This matrix inspires the research questions which guide this study:

- RQ1a: What digital literacy skills do first-year students possess?
- RQ1b: Is there a discrepancy between students' digital literacy skills based on self-assessment of their own tech savviness?
- RQ2a: What higher level data literacy skills do first-year students possess?
- RQ2b: Is there a discrepancy between students' data literacy skills based on self-assessment of their own tech savviness?

Data Collection

To evaluate the research questions, the authors created an online survey using Qualtrics (see Appendix A) which asked students to provide the following information:

- Demographics including age, gender, ethnicity, first-generation status, location of high school
- Hardware information including college and high school computers used, how often devices are used, which devices are used for which tasks
- High school information including IT topics learned as part of a course, programming languages studied
- Self-ranking of whether respondents consider themselves "tech-savvy"
- Self-ranking of their ability to complete specific tasks using a computer or common productivity applications (word processing, spreadsheets, presentation software, databases, email, operating system, cloud storage, web browser, digital media, other tasks)
- Self-ranking of data literacy framework competencies (discovery, quality, collection, management, analysis, interpretation, visualization, presentation, and decision making)
- Identification of the most important technology skills that students feel they need for success in college and their careers

The survey included multiple choice, multiple answer, open-ended questions, and scaled responses using Likert-type scales. Competency-based questions were reviewed by several IT professors and authors of IT textbooks to affirm that the researchers' assessments of beginner, intermediate, and expert tasks were accurate.

Digital literacy competency questions were created after reviewing the literature and standards created by JISC (2014), IEEE (2021) and information literacy value rubrics by AACU (2013).

Data literacy questions and corresponding factor level responses directly followed the Databilities Framework (Data to the People, 2022). While the framework assesses skills across 15 core competencies, several of these were advanced skills that had no means of measuring lower-level skills and therefore were excluded from this study. As a result, we surveyed students based on 10 of the 15 core competencies. These 10 competencies broken out along their three categories included:

- Reading
  - Data Discovery
  - Quality – Trustworthiness
  - Quality – Errors
- Writing
  - Collection
  - Management
- Comprehension
  - Analysis
  - Interpretation
  - Visualization
  - Presentation
  - Decision Making

Sample

Students enrolled in either CS100 "Introduction to Information Technology" (University A) or "Introduction to Data Literacy" (University B) were offered this survey. Participating students completed this survey during the first weeks of either the Fall 2022 or Spring 2023 semester (n=1164). Both courses primarily serve first-year and transfer students (96.44%). Students self-selected into the survey by agreeing to participate (n=1132). Respondents received no remuneration for participation. Survey results for the Databilities questions are shown in Appendix B.

To remove missing values resulting from survey fatigue, the sample was further reduced to include students that spent greater than 6 minutes of response time (n= 982). In addition, two respondents under the age of 18 were excluded to abide by Institutional Review Board requirements. Finally, the sample was subset to remove 120 transfer students from analysis as we are interested in the skills of incoming first-year students (n=860, 74%). After eliminating incomplete surveys, the final count was n=860. 63.3% of respondents identify as male while 36.7% identify as female. 62% of respondents identified as White, 11.6% Asian or Asian Indian, 6.5% Hispanic, Latino, or Spanish, 5.1% Black or African American, 2.2% Middle Eastern or Northern Africa, and 12.6% as multiracial or

other.

Data Analysis

Data was downloaded from Qualtrics in csv format and uploaded into R Studio for analysis. Manipulation and cleansing were performed to prepare a desired variable format, most noticeably compressing digital literacy survey questions to an average for the six specific tasks surveyed per skill. Principal Component Analysis (PCA) (Hotelling, 1933; Pearson, 1901), using Varimax rotation, was performed as a form of clustering to uncover important features within the data.

PCA is a statistical method used to obtain a reduced set of orthogonal linear projections given original correlated variables, where the projections, or components, are ordered by decreasing variances. We perform PCA to better understand RQ1a and RQ2a while examining if literacy skills group together and if so, which skills have been self-reported as most similar.

We look to identify if a subset of skills will emerge as technologically "strong" or "weak". This can be interpreted as a proxy for a group of skills being taught, or lack thereof, at the High School level. Orthogonalization allows us to determine that skill groups, components, are uncorrelated from each other. Given this objective, PCA is an appropriate method to identify unique skill sets belonging to students.

Each component consists of factor loadings, for all variables, indicating their relationship to the component. According to Hair et. al. (2006), factor loading coefficients of at least 0.5 specify that the variable is related to the component. Greater coefficients indicate larger amounts of feature variation retained in the component. We use 0.5 as our coefficient cutoff for variable retention in every component. Using this threshold, we follow conventional reporting techniques of PCA in removing values less than the cutoff to emphasize the underlying structure of each component (Hair, 2006).

A limitation of PCA is that it does not handle outliers very well. We feel comfortable using this technique given the construction of our instrument in that all survey response levels are homogenous. We employed two thresholds to determine the optimal number of components (i) eigenvalues greater than approximately 1 and (ii) cumulative proportion of variance criterion.

The first approach only keeps components with approximately one or more variables worth of information in it, the second states that at least 90% of the variance in the sample must be accounted for in the components. Given these guidelines, we found the suitable number of components to be 9 for digital skills and 7 for data literacy skills.

4. RESULTS

Our analysis aims to provide a more nuanced understanding of digital and data literacy skills of first-year college students by dividing the group into those who consider themselves "tech savvy" and those who do not.

Tech Savviness

While the Chronicle of Higher Education survey (Tugend, 2023) found 97% of students considered themselves to be highly or somewhat digital proficient, a similar question in this study, in which students evaluated the extent to which they agreed with the statement "I consider myself to be tech-savvy," had vastly different results. Our results showed that only 32.6% agreed or strongly agreed with the statement, 40.4% were neutral, and 26.9% either disagreed or strongly disagreed (see Figure 3). This suggests that the wording of questions related to understanding technology skills is critical. While students may have bought into the notion of being digital natives, this notion is quickly challenged when students are asked more pointed questions.

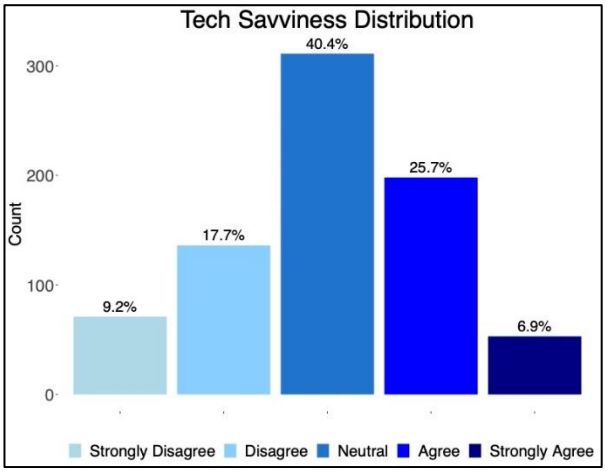

Figure 3. Self-Reported Tech Savviness

Throughout the rest of the analysis, we classified those who responded "agreed" or "strongly agreed" as being "tech savvy", those that responded "disagreed" and "strongly disagreed" as not being "tech savvy", and the remainder were kept "neutral" as shown in Figure 3. When comparing the "high tech savvy" versus the "low

tech savvy" groups, the "neutral" group was ignored.

Analysis of Digital Literacy Skills and Data Literacy Skills of Tech Savvy Students

We begin analyzing the technology related skills by looking to see if there is a correlation between self-reported tech savviness and our measures for both the digital skills and data literacy (See the correlation matrix in Figure 4).

First, we notice that there are stronger correlations between the data literacy components (shaded purple) than there are among the digital literacy components (shaded orange).

Second, it is interesting to note that there is not a strong correlation between any specific digital literacy skills. We may have expected to see high correlations between the "office suite" of skills (word processing, spreadsheets, presentations), but this was not the case.

Finally, in looking at the skills and their relationship to our tech savviness indicator (last column boxed in red), unsurprisingly, all measures are positive indicating that those who consider themselves tech savvy also report higher scores across the entire question dataset for both digital literacy and data literacy skills. However, no common suite of skills stands out amongst the tech savvy, as all correlations rate either negligible (0.0 to 0.30) or low (0.30 to 0.50) using the interpretation set forth by Hinkle and Wiersma (2003).

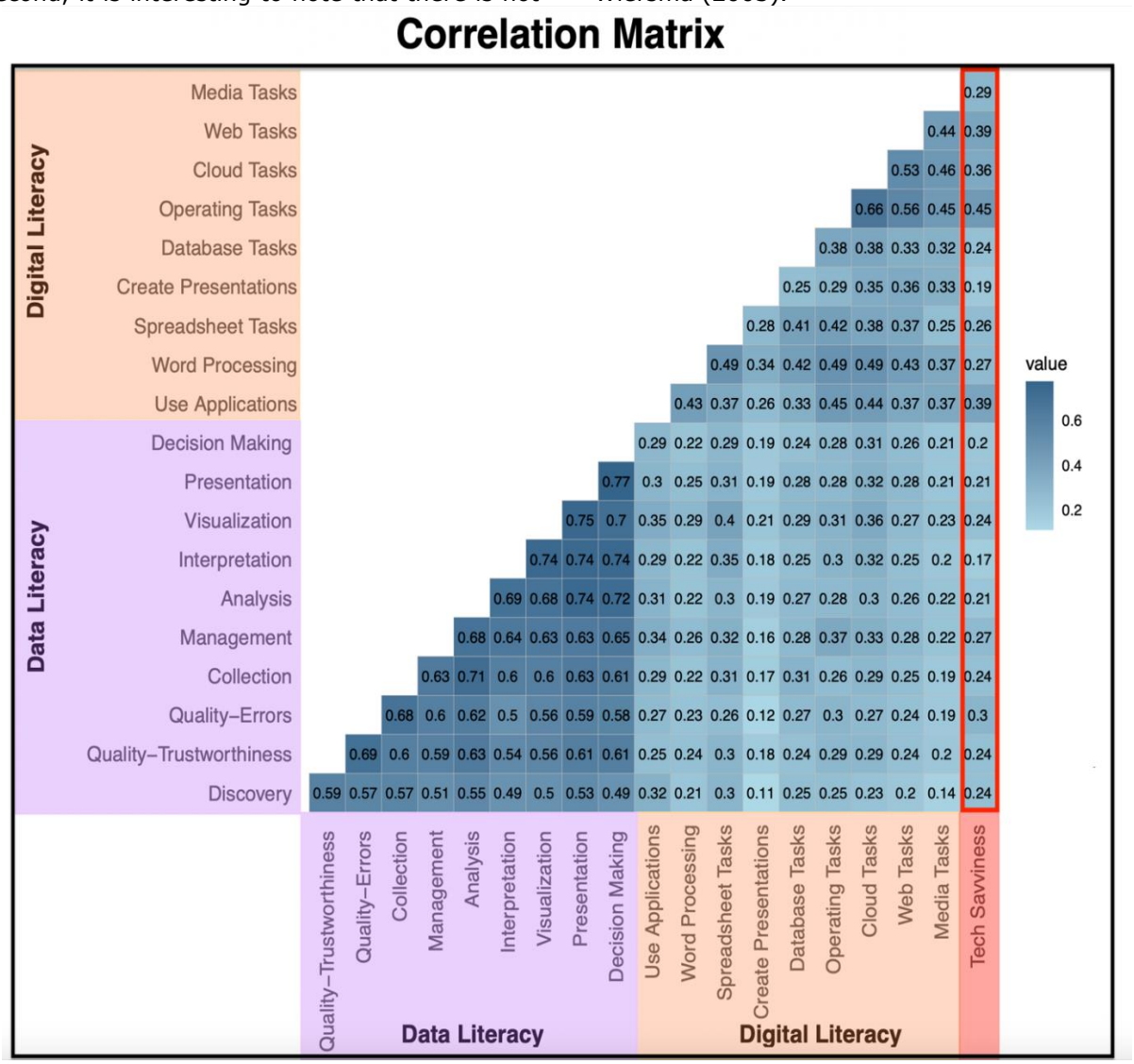

Figure 4. Correlation Matrix of Digital Literacy and Data Literacy Skills

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7	Comp 8	Comp 9
Use Applications		0.93							
Word Processing							0.89		
Spreadsheet Tasks					0.93				
Create Presentations	0.96								
Database Tasks			0.94						
Operating Tasks									0.85
Cloud Tasks								0.86	
Web Tasks						0.90			
Media Tasks				0.93					

Figure 5. Principal Component Analysis (Digital Literacy)

Digital Literacy Skills

We next wanted to know whether there was a core set of digital literacy skills that all students brought with them to college. Understanding this would allow us to focus on skills often taught in first-year technology courses that needed more attention versus those that all or most students possessed before coming to college.

To reduce the number of dimensions in the data, we performed a principal component analysis to find relationships between sets of digital literacy skills that all students possess. Figure 5 shows the result of that analysis and, surprisingly, we found that there were no core set of digital literacy skills that merged into one principal component.

The first component, containing the largest sample variation, is comprised mostly of the create presentations skill. All components form singletons, meaning that they are approximately built upon the original set of features. The singleton structure confirms the results that we obtain in the correlation matrix which shows low correlation between digital literacy skills.

Looking at the average response for the digital literacy skills, as shown in Figure 6, the digital skills that students were most comfortable with include creating presentations and performing media tasks, while they were least comfortable with using applications, performing spreadsheet tasks, and performing database tasks.

We next consider the digital literacy skills broken out by tech savviness (Figure 7). Both groups appear comfortable with creating presentations, but that is the only digital literacy skill that is positive for both groups. For the tech savvy group, a majority are comfortable with media, operating (system), cloud, and web tasks, while their responses related to database tasks, using applications, spreadsheet, and word processing tasks are neutral.

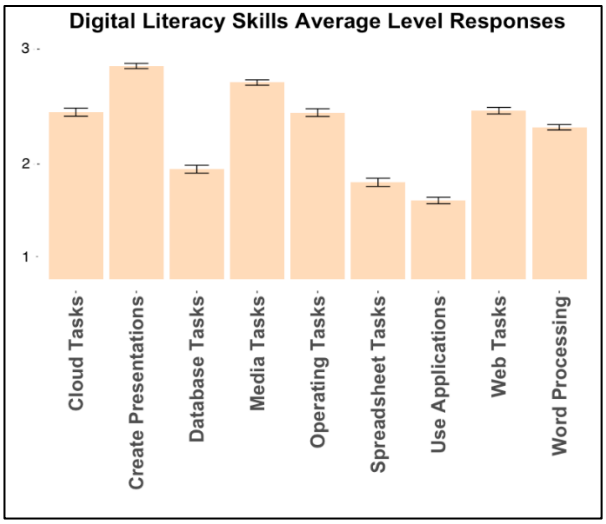

Figure 6. Digital Literacy Skills

For those who do not consider themselves tech savvy the only skills the majority of the students feel comfortable with are presentations and media tasks. The one skill this group clearly felt uncomfortable with was using applications. On all other skills the respondents were neutral.

A general pattern emerges across all digital literacy skills measured; there is a clear gap between the skills of the two groups. The smallest difference between the two groups was in creating presentations, the digital skill in which both groups also scored highest. The weakest skills for both groups were in using applications, spreadsheet tasks, and database tasks. Operating (system) tasks, cloud tasks, and using applications are the areas that represent the greatest skill differences between the two groups.

The concurrent trending of analysis, presentation, and decision making suggest that students are aware that they need to review and evaluate data before they can share it with others or understand it well enough to make informed decisions based on it.

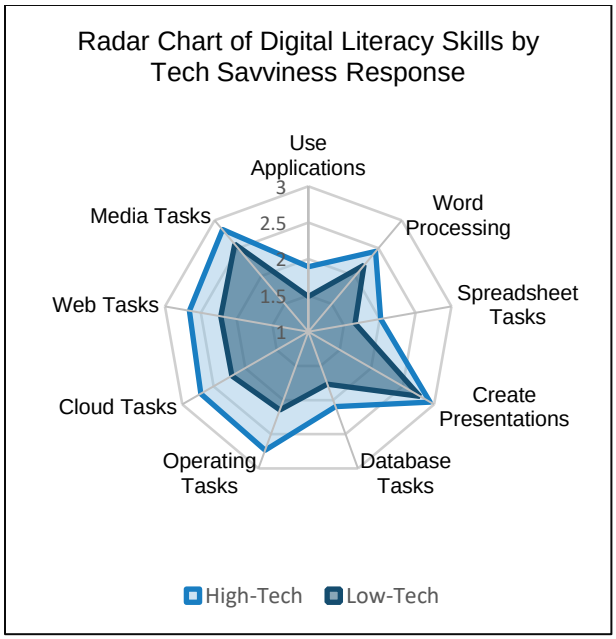

Figure 7. Radar Chart of tech skills for high- and low-tech savviness

Data Literacy Skills

We followed the same approach used to examine the digital skills when evaluating the data literacy questions and responses. We began by performing the principal component analysis to better understand whether certain data literacies correlated with each other. However, unlike the digital skills, we did have principal components emerge with more than one data literacy competency (Figure 8).

Our first principal component showed that analysis, presentation, and decision making trended together. Our second principal component grouped interpretation and visualization.

No other skills combined under a single principal component meaning that first-year students do not have a common skillset that they bring with them to college.

Figure 9 details the average level of data skills for students and serves to determine if the ability to comprehend data is being 'taught or forgot'. Students claimed to be better at analysis, decision making, and interpreting data, whereas respondents lacked skills in determining the quality of data, discovering new data, and collecting data.

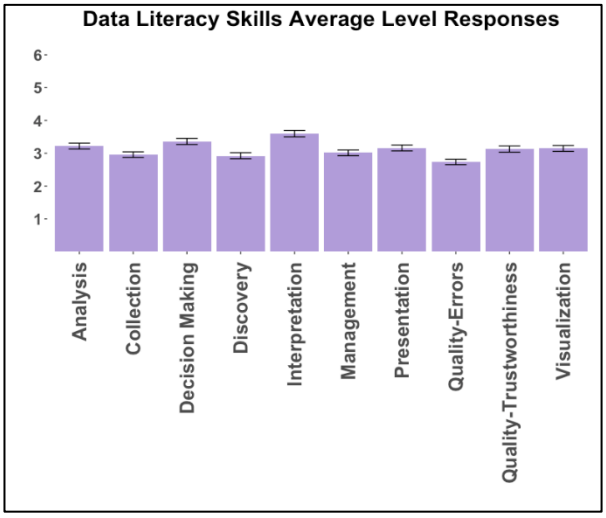

Figure 9. Data Literacy Skills

We next consider the data skills broken down by those who are less and more tech savvy. Similar to the digital skills findings, students with higher tech savviness consistently score at higher levels across all categories than students with self-reported lower tech savviness. With both groups, the weakest skills appear to be in the areas of Discovery and Quality – Errors.

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7
Discovery				0.89			
Quality-Trustworthiness						0.82	
Quality-Errors							0.78
Collection			0.79				
Management					0.82		
Analysis	0.63						
Interpretation		0.70					
Visualization		0.80					
Presentation	0.66						
Decision Making	0.74						

Figure 8. Principal Component Analysis (Databilities Data Literacy Skills)

These results suggest that while both groups have data comprehension skills, many performing at higher levels, even the majority of tech savvy sudents can improve their data literacy skills in these areas.

Additionally, we observe that these five clustered competencies all belong to the Comprehension branch of data literacy, as defined by Databilities, and shown in red in the radar chart in Figure 10. The grouped components represent topics often taught in many secondary schools.

Outcomes are corraborated in the radar chart (Figure 10). Datalabels are color coded to match the three branches of data literacy: purple (reading), green (writing), red (comprehension). We observe the chart trend toward the direction of the red colored labels, indicating outperformance from both tech savviness groups in the areas of decision making, presentation, visualization, interpretation, and analysis.

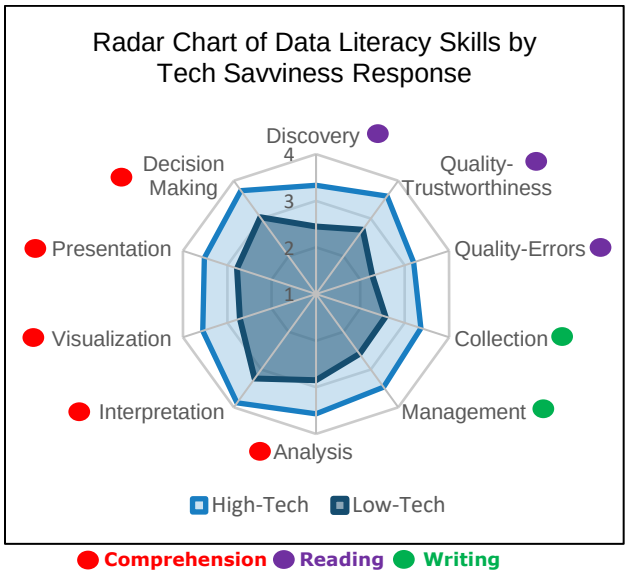

Figure 10. Radar Chart of Databilities skills for high- and low-tech savviness

5. DISCUSSION AND CONCLUSIONS

The results of this study suggest that while only 32% of those surveyed at both participating institutions agreed or strongly agreed that they considered themselves to be tech savvy, incoming first-year college students need to further develop their data literacy skills, especially in the areas of collecting, managing, and evaluating the quality of data. Most students were performing at the lowest levels of the digital literacy framework in all areas except for interpretation, meaning that they can complete simple tasks with instruction or some guidance. We hypothesize that their higher levels of assessment regarding data visualization is due to prior study of Excel or other spreadsheet software, where students are often introduced to making different types of charts and graphs.

Our data did not show a strong correlation between any specific digital literacy skills. We anticipated high correlations between office productivity tools because many students come to college having at least basic knowledge of them. Many productivity tools incorporate "wizards" or artificial intelligence capabilities to guide the user into creating impressive presentations or complex documents, even though their prior experience is beginner level at best.

While we expected that more specialized skills such as operating (system) tasks, database tasks, and cloud tasks were not uniformly learned, we did expect basic productivity skills related to word processing, spreadsheets, and presentations to trend together. The assumption that students who knew how to use one productivity tool were more likely to know how to use the others was incorrect. This suggests that there is no common core of skills being taught at high schools where our first-year students attended, and that introductory technology classes in college cannot assume that knowledge in one skill suggests knowledge in another skill.

Although digital natives are adept with using technology for personal pursuits, the misconception remains that they are also qualified to complete well defined tasks and problems using data independently or show others how to complete simple or complex problems and tasks.

Our findings suggest that students are trained to comprehend data rather than read or write it. Insights can be developed into proper course preparation at the collegiate level by spending additional training within reading and writing data. To truly comprehend data, one must be able to collect and manage data, and evaluate its quality.

The authors acknowledge limitations of this study: first, the study was based on students' self-assessment, rather than an objective assessment of their abilities to complete various tasks that demonstrate their data and digital literacy skills, and second; the study was conducted at two business-focused institutions. Results may vary among populations of students

at liberal arts colleges, community colleges, or other types of institutions of higher education.

The authors recommend that institutions take advantage of the fact that students believe productivity skills are important (spreadsheets, programming, word processing), and further introduce them to tools and techniques for presenting, visualizing, interpreting, analyzing, managing, collecting, and evaluating the quality of data so that they will develop skills necessary for success in the workplace.

The data literacy competencies that students come in with when they begin their college careers are generally not sufficient to succeed in college or in the workplace. Additional instruction will be necessary to make up the areas where skills are deficient and strengthen those areas where they have some prior experience.

Students who develop data literacy skills will know what questions to ask, how to make informed decisions, and what to say when sharing their results with others. Developing data literacy skills is necessary to make informed decisions based on evaluating data that will position both college students and their future employers to succeed.

This work contributes to the growing body of knowledge around our understanding of tech-focused literacies by beginning to explore the differences found in data literacy versus digital literacy. With the rise in mass adoption of artificial intelligence tools such as ChatGPT, assessing underlying literacies of technology users will be instrumental in evaluating their capabilities and adoption rates of current technologies such as AI.

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Editor's Note:

This paper was selected for inclusion in the journal as a 2023 ISCAP Conference Distinguished Paper. The acceptance rate is typically 7% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2023.

Appendix A. Survey Instrument

Willingness to Participate

You are invited to participate in a research study on the use of technology as it relates to IT education. You were selected as a possible participant because you are enrolled in CS100 or DS 101. Please read this form and ask any questions you may have before agreeing to be in the study.

This study asks about your experiences learning about and using technology from high school to the present. If you agree to be in this study, you will be asked to answer several questions about your technology experiences. Your responses will be recorded and downloaded for analysis. The survey should take approximately 15 minutes to complete.

Click YES to participate. Click NO to withdraw from this survey.
- o Yes, I will participate.
- o No, I will not participate.

Skip To: End of Survey If Click YES to participate.

Demographics

In which course and section are you enrolled?
▼ (drop-down list of sections and instructors)

How old are you?
- o Under 18
- o 18-20
- o 21 or over

Skip To: End of Survey If How old are you? = Under 18

With which gender identity do you most identify?
- o Please choose one
- o female
- o male
- o transgender female
- o transgender male
- o gender variant/non-conforming
- o Not listed
- o Prefer not to answer

What is your race or ethnicity (please select all that apply):
- □ White
- □ Hispanic, Latino, or Spanish origin
- □ Black or African American
- □ Asian or Asian Indian
- □ Native American or Alaska Native
- □ Middle Eastern or North African
- □ Native Hawaiian or Other Pacific Islander
- □ Another race, ethnicity or origin

Are you a:
- o First-Year Student
- o Second, Third, or Fourth-Year Student
- o Transfer Student

Display This Question:
If Are you a: = Transfer Student

Did you take a technology class at your previous college?
- Yes
- No

Display This Question:
If Did you take a technology class at your previous college? = Yes

Did you receive credit for your technology course at a previous college?
- Yes
- No

The computer that you currently use for school is a:
- Mac
- Windows Computer
- Chromebook
- Other

The computer that you currently use for college was:
- Purchased through the college / university
- Purchased on my own
- One you had at home and/or used in high school

Where did you attend high school?
- New England (MA, NH, CT, RI, VT, ME)
- Elsewhere in the US
- Outside of the US

Are you the first person in your family to go to college?
- Yes
- No

What is your major?
_____

High School Experience

Where would you most often use a computer when completing homework assignments in high school?
- A computer in a lab at school
- A computer at the public library
- A computer at home

Which of these topics, if any, did you learn as part of a course in high school?
- □ Programming
- □ Web Design / Making Websites
- □ Digital photography
- □ Digital video production
- □ Digital audio production
- □ Computer Science
- □ Word Processing
- □ Spreadsheets
- □ Presentation Software
- □ Email
- □ Databases
- □ How to use the World Wide Web

- □ Social Media

Display This Question:
If Which of these topics, if any, did you learn as part of a course in high school? = Programming

Which programming languages or environments did you learn in high school? (Check all that apply)
- □ Alice
- □ Scratch
- □ Java
- □ JavaScript
- □ C or C#
- □ Python
- □ HTML
- □ Visual Basic
- □ Other

Which computer or device did you use most in high school?
- o Google Chromebook (Desktop or Laptop)
- o Windows Computer (Desktop or Laptop)
- o Mac Computer (Desktop or Laptop)
- o Linux Computer (Desktop or Laptop)
- o iPad (41)
- o Android Tablet
- o Other
- o

Did you take an AP Computer Science Test?
- o Yes
- o No

Did you work or volunteer as a help desk, computer lab assistant, or technology tutor while in high school?
- o Yes
- o No

Your Current Use of Computers and Devices

How often do you use these devices?

	Rarely/Never	Weekly	Daily
Iphone	o	o	o
Android phone	o	o	o
Other mobile phone	o	o	o
Smart Watch	o	o	o
Ipad or Tablet	o	o	o
Raspberry Pi	o	o	o
Laptop	o	o	o
Gaming Device	o	o	o
VR Headset	o	o	o
Smart Speaker (Alexa/Google Home)	o	o	o

Which device(s) do you use to perform the following tasks?

	Laptop/Desktop	Tablet	Mobile Phone
Watch a video	▢	▢	▢
Send email	▢	▢	▢
Send a text message	▢	▢	▢
Visit websites	▢	▢	▢
Use a search engine	▢	▢	▢
Edit a document	▢	▢	▢
Make an online purchase	▢	▢	▢
Listen to music	▢	▢	▢
Take a photo	▢	▢	▢
Edit a photo	▢	▢	▢
Post a photo to social media	▢	▢	▢

How many times per day do you currently use the following social media apps?

	Never	1 to 5 times	6 to 10 times	More than 10
Facebook	o	o	o	o
Twitter	o	o	o	o
Instagram	o	o	o	o
Snapchat	o	o	o	o
LinkedIn	o	o	o	o

Your Tech Skills

Keep up the good work! You're about half-way there! This section has 11 questions related to tasks you might know how to complete with various software applications.

Rate your ability to use each of these *applications* before you came to college.

	Beginner	Intermediate	Expert
Word Processing	o	o	o
Spreadsheets	o	o	o
Presentation Software	o	o	o
Database Software	o	o	o
Email Software	o	o	o
Your computer's operating system (Windows or Mac OS)	o	o	o
Cloud Storage (Google Drive, Dropbox, OneDrive, etc.)	o	o	o
Web Browsers	o	o	o
Digital Media Editing (photos, videos, music)	o	o	o
Online and Social Collaboration	o	o	o
Online calendar	o	o	o

Rate your ability to perform these *word processing* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Format text using bold, underline, or different fonts and sizes to change the appearance of a document	o	o	o
Add page numbers to a document	o	o	o
Perform a mail merge	o	o	o
Use the references feature to create a bibliography	o	o	o
Add a picture to a document	o	o	o
Use the format painter	o	o	o

Rate your ability to perform these *spreadsheet* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Create a basic pie, line, or bar chart	o	o	o
Write formulas in excel using references such as A1	o	o	o
Create a pivot table	o	o	o
Write formulas to look up values in a table	o	o	o
Write a formula to calculate the sum of two numbers if they are equal, and calculate their product if not equal	o	o	o
Write a formula to calculate the sum of a range of cells	o	o	o

Rate your ability to perform these *presentation software* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Use fonts and styles to change the appearance of a slide	o	o	o
Modify a slide's background	o	o	o
Apply slide transitions and animations	o	o	o
Apply a theme to your presentation	o	o	o
Insert shapes or images	o	o	o
Modify a slide's layout pattern	o	o	o

Rate your ability to perform these *database* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Create a table to store data	o	o	o
Add data to a table	o	o	o
Create a report	o	o	o
Add a primary key	o	o	o
Relate information in two different tables	o	o	o
Find records that match a specific condition (such as all employees from Connecticut)	o	o	o

Rate your ability to perform these *e-mail* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Send a message	o	o	o
Send a message with an attachment	o	o	o
Send a message encrypted for security	o	o	o
Organize messages in folders	o	o	o
Reply to everyone who received a message	o	o	o
Delete messages from your inbox	o	o	o

Rate your ability to perform these *operating system* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Create a new folder	o	o	o
Zip or compress a file	o	o	o
See how much free storage remains on your hard drive	o	o	o
Install or uninstall a program	o	o	o
Copy a file from one folder to another	o	o	o
Back up files on your computer	o	o	o

Rate your ability to perform *these cloud storage service* (such as OneDrive, Google Drive, or Dropbox) tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Upload your files to the cloud from your computer or mobile device	o	o	o
Access your files in the cloud from your computer or mobile device	o	o	o
Share a link to a document stored in the cloud with someone else	o	o	o
Synchronize your files stored in the cloud across multiple devices	o	o	o
Edit a document stored in the cloud collaboratively at the same time as someone else	o	o	o
Specify folders on your computer to store on the cloud	o	o	o

Rate your ability to perform these *web browser* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Accept cookies	o	o	o
Bookmark a website	o	o	o
View HTML source code of a website	o	o	o
Clear your browser's cache	o	o	o
Build a search query to limit search results using modifiers	o	o	o
Get directions using an online mapping service	o	o	o

Rate your ability to perform these *digital media* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Crop or resize a photo	o	o	o
Cut a section from a video clip	o	o	o
Flip or rotate an image	o	o	o
Add a title or credits to a video	o	o	o
Publish a video to YouTube	o	o	o
Make a podcast	o	o	o

Rate your ability to perform these *social media* tasks before you came to college.

	Don't know what this is	Heard of it, but don't know how to do it	Know how to do it
Write a post to a blog or social media site	o	o	o
Set up a blog or website using a content management tool	o	o	o
Write a comment on a blog or social media post	o	o	o
Make a video call or participate in a video conference	o	o	o
Create an appointment on an online calendar	o	o	o
Specify which friends or groups of friends can see your posts to Facebook	o	o	o

Important to Know

To what extent do you agree with each of these statements?

Coding is a valuable skill to have.				
o	o	o	o	o
I am concerned about my privacy online.				
o	o	o	o	o
I would like to build mobile apps.				
o	o	o	o	o
I consider myself to be tech-savvy.				
o	o	o	o	o
I understand how technology works and know how to use it responsibly.				
o	o	o	o	o
I can explain good practices for selecting a strong password for my accounts online.				
o	o	o	o	o
I can explain different ways to protect my technology systems and information from unethical users.				
o	o	o	o	o
I can explain basic practices that contribute to a website's accessibility to people with disabilities.				
o	o	o	o	o

What three technology skills do you think are the most important that will help prepare you for your college education then into your future career?

_____
_____
_____
_____
_____

Your Data Skills

Which of these statements best describe you?

- o With guidance, I can open and use datasets provided to me
- o I can open and use datasets provided to me
- o I can identify and access data I need from a range of sources provided to me
- o I can identify, locate, and access data I need from a variety of sources
- o I can assist others to identify and access data they need from a range of provided sources
- o None of these describe me

Which of these statements best describe you?
- With guidance, I can identify whether the data provided to me is trustworthy
- I can identify whether the data provided to me is trustworthy
- I can identify whether data I use is trustworthy
- I can identify whether data I use is trustworthy and locate alternative sources if required
- I can assist others to identify whether data they use is trustworthy
- None of these describe me

Which of these statements best describe you?
- With guidance, I can determine whether data provided to me contains any errors or problems
- I can determine whether data provided to me contains any errors or problems
- I can determine whether data contains any errors or problems
- I can identify and take actions to correct any errors or problems in a range of data sources
- I can assist others to identify and errors or problems in a range of data sources
- None of these describe me

Which of these statements best describe you?
- With guidance, I can collect simple data in a format provided to me
- I can collect simple data in a format provided to me
- I can collect data in simple and more complex forms
- I can collect data in a variety of forms to support my needs
- I can assist others to collect data in forms to support their needs
- None of these describe me

Which of these statements best describe you?
- With guidance, I can navigate structured organization systems (including folders, directories, and file naming) to find data I need
- I can navigate structured organization systems (including folders, directories, and file naming) to find data I need
- I can navigate database models to locate data related to my needs
- I can navigate database models to locate and retrieve data related to my needs
- I can assist others to navigate organizational systems and database models to locate and retrieve data related to their needs
- None of these describe me

Which of these statements best describe you?
- With guidance, I can ask and answer basic questions with data provided to me
- I can ask and answer basic questions with data provided to me
- I can ask and answer a range of questions with data provided to me
- I can ask and answer a range of questions using a variety of data sources
- I can assist others to ask and answer a range of questions using a variety of data sources
- None of these describe me

Which of these statements best describe you?
- With guidance, I can read and understand simple tables, charts, and graphs provided to me
- I can read and understand simple tables, charts, and graphs provided to me
- I can read and understand simple tables, charts, and graphs
- I can read and understand a range of tables, charts, and graphs
- I can assist others to read and understand a range of tables, charts, and graphs
- None of these describe me

Which of these statements best describe you?
- With guidance, I can use templates to create simple tables and charts to visually present data provided to me
- I can use templates to create meaningful tables and charts to visually present data provided to me
- I can create meaningful tables and charts to visually present simple datasets
- I can create meaningful tables and charts to visually present a range of data sources
- I can assist others to create meaningful tables and charts to visually present simple data sources
- None of these describe me

Which of these statements best describe you?
- With guidance, I can verbally describe key points of interest in data provided to me
- I can verbally describe key points of interest in data provided to me
- I can verbally describe simple datasets and data visualizations
- I can verbally describe a range of data sources and data visualizations
- I can assist others to verbally describe provided data sources and data visualizations
- None of these describe me

Which of these statements best describe you?
- With guidance, I can use data provided to me to support my decision-making process
- I can use data provided to me to support my decision-making process
- I can use data to inform my decision-making process
- I can use data to analyze and inform my data-making process
- I can assist others to use data to analyze and inform their decision-making process
- None of these describe me

End of Survey

Appendix B. Survey Results of Databilities Questions

Discovery	%	Count
With guidance, I can open and use datasets provided to me	43.27%	518
I can open and use datasets provided to me	12.45%	149
I can identify and access data I need from a range of sources provided to me	14.29%	171
I can identify, locate, and access data I need from a variety of sources	16.37%	196
I can assist others to identify and access data they need from a range of provided sources	4.51%	54
None of these describe me	9.11%	109
Total	100%	1197

Analysis	%	Count
With guidance, I can ask and answer basic questions with data provided to me	27.30%	323
I can ask and answer basic questions with data provided to	25.95%	307
I can ask and answer a range of questions with data provided to me	18.09%	214
I can ask and answer a range of questions using a variety of data sources	15.72%	186
I can assist others to ask and answer a range of questions using a variety of data souces	6.51%	77
None of these describe me	6.42%	76
Total	100%	1183

Quality-Trustworthiness	%	Count
With guidance, I can identify whether the data provided to me is trustworthy	34.23%	407
I can identify whether the data provided to me is	19.68%	234
I can identify whether data I use is trustworthy	15.73%	187
I can identify whether data I use is trustworthy and locate alternative sources if required	16.23%	193
I can assist others to identify whether data they use is trustworthy	6.73%	80
None of these describe me	7.40%	88
Total	100%	1189

Interpretation	%	Count
With guidance, I can read and understand simple tables, charts, and graphs provided to me	20.92%	246
I can read and understand simple tables, charts, and graphs	22.36%	263
I can read and understand simple tables, charts, and graphs	15.48%	182
I can read and understand a range of tables, charts, and graphs	22.79%	268
I can assist others to read and understand a range of tables, charts, and graphs	13.18%	155
None of these describe me	5.27%	62
Total	100%	1176

Quality-Errors	%	Count
With guidance, I can determine whether data provided to me contains any errors or problems	44.01%	522
I can determine whether data provided to me contains any errors or problems	18.30%	217
I can determine whether data contains any errors or problems	15.68%	186
I can identify and take actions to correct any errors or problems in a range of data sources	9.95%	118
I can assist others to identify and errors or problems in a range of data sources	2.87%	34
None of these describe me	9.19%	109
Total	100%	1186

VIsualization	%	Count
With guidance, I can use templates to create simple tables and charts to visually present data provided to me	31.13%	368
I can use templates to create meaningful tables and charts to visually present data provided to me	23.86%	282
I can create meaningful tables and charts to visually present a range of data sources	15.06%	178
I can create meaningful tables and charts to visually present simple datasets	17.34%	205
I can assist others to create meaningful tables and charts to visually present simple data sources	6.26%	74
None of these describe me	6.35%	75
Total	100%	1182

Collection	%	Count
With guidance, I can collect simple data in a format provided to me	33.73%	401
I can collect simple data in a format provided to me	28.34%	337
I can collect data in simple and more complex forms	11.44%	136
I can collect data in a variety of forms to support my needs	13.79%	164
I can assist others to collect data in forms to support their needs	4.79%	57
None of these describe me	7.91%	94
Total	100%	1189

Presentation	%	Count
With guidance, I can verbally describe key points of interest in data provided to me	30.50%	362
I can verbally describe key points of interest in data provided to me	23.59%	280
I can verbally describe simple datasets and data visualizations	17.44%	207
I can verbally describe a range of data sources and data visualizations	15.92%	189
I can assist others to verbally describe provided data sources and data visualizations	5.64%	67
None of these describe me	6.91%	82
Total	100%	1187

Management	%	Count
With guidance, I can navigate structured organization systems (including folders, directories, and file naming) to find data I need	32.04%	380
I can navigate structured organization systems (including folders, directories, and file naming) to find data I need	29.17%	346
I can navigate database models to locate data related to my needs	13.24%	157
I can navigate database models to locate and retrieve data related to my needs	12.48%	148
I can assist others to navigate organizational systems and database models to locate and retrieve data related to their needs	5.90%	70
None of these describe me	7.17%	85
Total	100%	1186

Decision Making	%	Count
With guidance, I can use data provided to me to support my decision-making process	25.95%	308
I can use data provided to me to support my decision-making process	23.50%	279
I can use data to inform my decision-making process	18.37%	218
I can use data to analyze and inform my data-making process	19.97%	237
I can assist others to use use data to analyze and inform their decision-making process	6.49%	77
None of these describe me	5.73%	68
Total	100%	1187